REPORT OF ANNUAL MEETING OF AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS

Vol. XIX. September, 1900. No. 3.

PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS. STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

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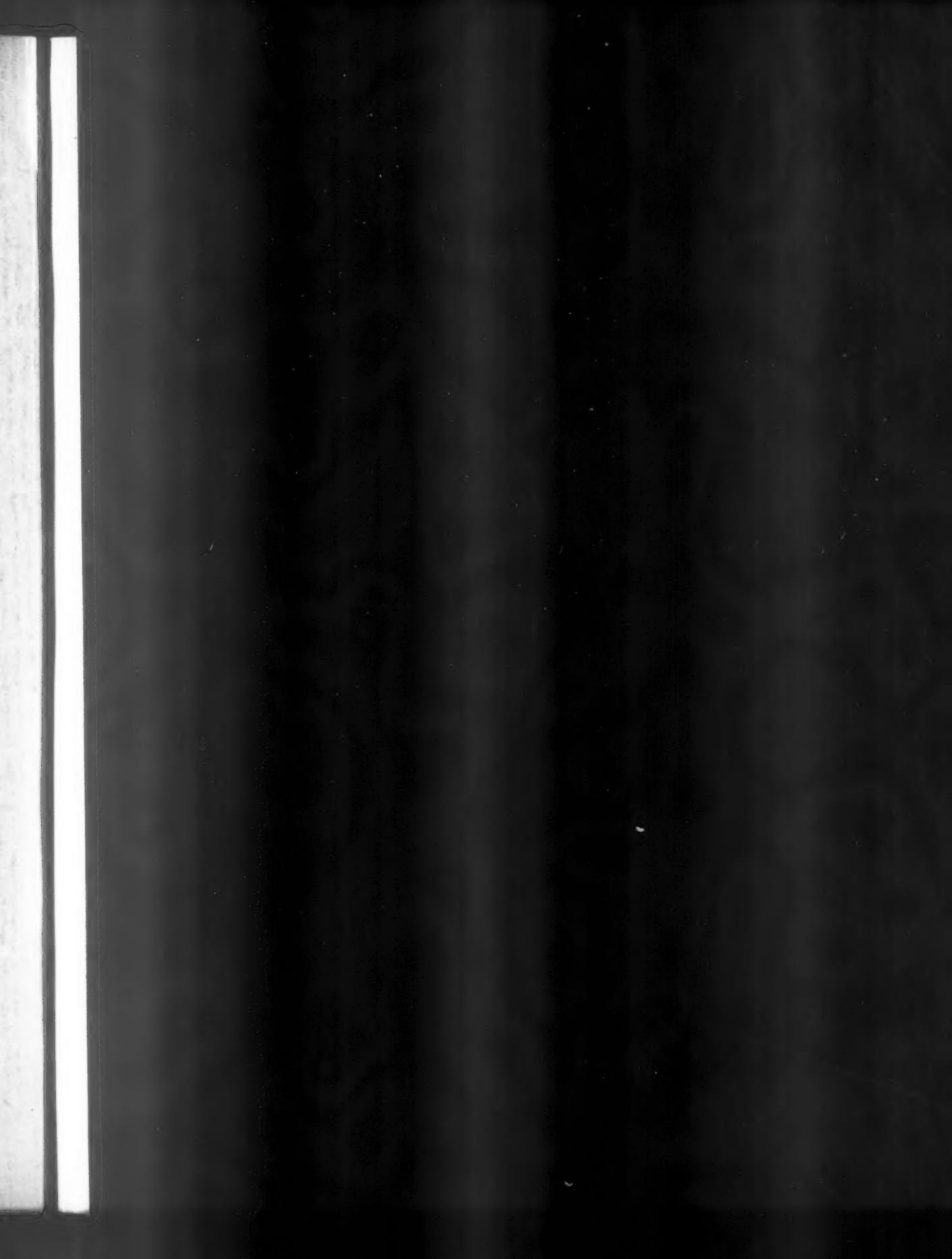

Municipal Engineering

VOLUME XIX. SEPTEMBER, NINETEEN HUNDRED. NUMBER 3.

HOW TO BUILD CITIES.

DISCUSSION OF PRACTICAL QUESTIONS RELATING TO MUNICIPAL WORK, AT THE ANNUAL MEETING OF THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS IN MILWAUKEE, AUGUST 28 TO 31.

TO those who attend the conventions of national organizations the place of meeting is always an interesting consideration, but to the members of the American Society of Municipal Improvements this is a question of exceptional importance, as from it is largely derived the profit, as well as the pleasure, of the occasion, be-

NATIONAL SOLDIER'S HOME, MILWAUKEE.

cause, as men who are in charge of the practical affairs of municipalities, they go to these annual meetings seeking information that may be helpful to them in their work, and this knowledge is often more usefully obtained through the sense of seeing than that of hearing. Where the advantages of both an interesting meeting and meeting-place are combined, they realize in the fullest measure the purposes for which they are brought together.

The annual meetings of the American Society of Municipal Improvements have, fortunately, been held, as a rule, in cities which are in themselves interesting to city builders. This is quite true of Milwaukee, where the society has just held its annual meeting, beginning on Tuesday, August 28th, and closing on the 31st. The city is physically interesting, and to such men as compose the American Society of Municipal Improvements, it is, as the place where some famous engineering work was done under the direction of Mr. Geo. H. Benzenberg, while for twenty-five years its city engineer, of special interest. Mr. Benzenberg has long been one of the most prominent figures in the country before the various organizations devoted to practical municipal affairs, and among such men there is naturally a strong interest in seeing something of the real work accomplished under Mr. Benzenberg's own hands. To those who attended the Milwaukee meet-

ing of the American Society of Municipal Improvements there was in this respect no disappointment, and in its pleasurable features of entertainment by the city officials of Milwaukee the visit will be memorable.

MR. GEO. H. BENZENBERG, C. E.,
City Engineer of Milwaukee for Twenty-Five Years.

The city is at its best during the summer months, when the attractive features of a great lake, a profusion of shade trees and the many pleasant nooks of a delightful summer city are most refreshing. The street pavements, the water and sewer systems, its exceptionally artistic bridges, its attractive parks and other attributes of progressive urban life, were of interest to men who examine such features with better knowledge and from a more critical point of view than most visitors. Glimpses of many of these features of the city are given to those who were not in attendance at the meeting in the illustrations which appear in this number of MUNICIPAL ENGINEERING.

REPORT OF PROCEEDINGS.

In accordance with his reputation for promptness, President A. D. Thompson called the convention to order for the first session on Tuesday afternoon. Mayor S. L. Rose, of Milwaukee, delivered an address of welcome, expressing his special pleasure in meeting this convention as a medium of benefit to the city, particularly to its officials. Milwaukee has a municipal league, open to its citizens without reference to their particular technical ability on municipal questions, which, among other things, has prepared a model charter. "I believe the government belongs to the people, and that it should be kept as close as possible to the people. In Wisconsin the legislature is the center of the action of government. It delegates power to the municipalities. This is wrong. No charter can be adopted by a legislature outside of the interests of the city which will fit its needs. Municipalities should have absolute right of home rule.

LEIF ERICSON'S STATUE, MILWAUKEE.

"To make improvements in Mil-

A PLEASANT SPOT ON MILWAUKEE RIVER.

waukee we must first see if power has been delegated to the city to do the work, and if it has not we must apply to the legislature for permission. Thus legislators from the country and with no knowledge of city conditions manage this municipality. Under this policy the city is exposed to disadvantageous influences. The state is interested in but three things in the city. First, that it should pay its proper share of taxes; second, that police laws should be enforced; third, that health laws be observed. Thus, for example, the power for the sale of bonds is really no business of the legislature."

As a preparation for the visits of the convention to the various interests in the city, the mayor gave some interesting statistics regarding its growth and the nature of its improvements, and their cost.

Incidentally, he stated that there are now 26,000 water takers using meters, and from 6,000 to 7,000 not using meters. The meter rate is 4½ cents per 100 cubic feet, without reference to the amount of water used, thus relieving the domestic user of the unequal share which he usually bears. The city pays for the water used as an ordinary consumer. The city has decided upon many small parks, rather than a few large ones.

President Thompson responded for the society, calling attention to the great influence which Milwaukee has had in the development of the society, through Mr. Benzenberg and others.

CITY HALL, MILWAUKEE.

Seventeen new members were admitted; and other applications were received during the day. They were J. H. Emigh, city engineer, North Adams, Mass.; L. W. Anderson, city engineer, Grand Rapids, Mich.; G. H. Stanchfield, city engineer, Watertown, Wis.; B. J. Ashley, Chicago; T. F. McGilvery, city engineer, Duluth, Minn.; D. W. Mead, C. E., Chicago; G. Christie, mayor's clerk, Robert Allison, S. Weil, W. Magley, W. C. Johnson, M. A. McGuire, board of public affairs, Cincinnati, O.;

VIEWS IN SCHLITZ PARK, MILWAUKEE.

E. D. Very, city engineer, Niagara Falls, N. Y.; Geo. A. Hotchkiss, superintendent water works, Rochester, N. Y.; Frank Mezerowski, board of public works, Milwaukee; E. A. Steece, city engineer, John

A. D. THOMPSON,
Retiring President American Society Municipal Improvements.

Sterling, chairman improvement committee, board of aldermen, Burlington, Iowa.

President Thompson then addressed the convention as follows:

During the last decade there has developed a strong popular interest in affairs relating to municipalities, from which has sprung a demand for an improved system of city government that will provide an administration of affairs yielding a fair and equitable return for the enormous expenses of operation. This solicitude has been created largely through the efforts of local, state and national organizations devoted to the study of the various branches of this question, and is the first step necessary to procure beneficial and definite results. The work of this or similar organizations depends for its effectiveness upon a general interest among the people in such matters, and it is encouraging to note that never before has there been exhibited such a keen and universal concern regarding city affairs.

Municipal questions in America are exceedingly difficult of solution because of the complications involved by numerous perplexing features prevailing in no other country. The principal influences that render the conditions difficult are:

1. The composition of the urban population, which is made up of all classes of every nationality, each individual of which has a voice in the government.

2. The extended area of the country includes extremes of climatic conditions, with the corresponding variation in temperament, involving alterations to suit different localities.

3. The rapid increase in total urban population with the proportion of same to the total population of the country.

American municipalities, therefore, have found it necessary to depart from the methods recognized in older countries in developing municipal systems, and no other feature of American government has been so strongly criticized by students of such matters. Mr. James Bryce, in his work on the American Commonwealth, says: "There is no denying that the government of cities is the one conspicuous failure of the United States," while other writers and students of such questions have been scarcely less severe in their criticisms. It is doubtful if our methods of conducting city affairs deserve such strong condemnation in view of the circumstances controlling city development, but it does not require an extended study of such matters to indicate numer-

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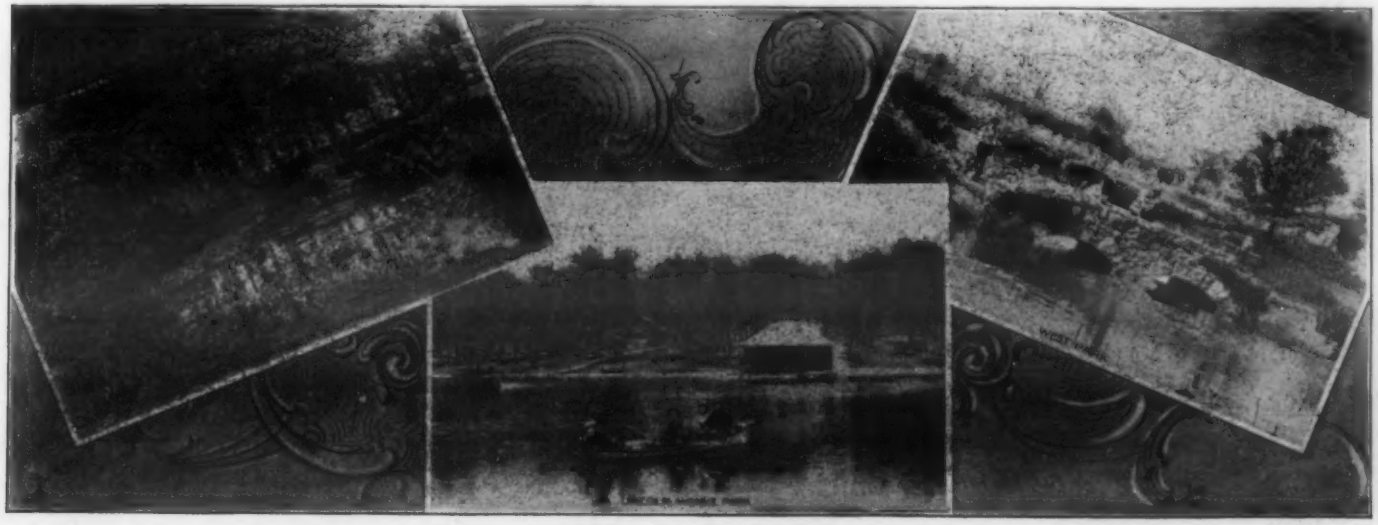


VIEWS IN MILWAUKEE PARKS.

ous defects and weaknesses in the general municipal system and in the methods of administering our city affairs.

Plans and suggestions for improvements have not been lacking from students, politicians and other citizens, but they have not resulted in the betterment of conditions. The main reasons for the failure of these efforts are that a large proportion of such plans are devised from a theoretical, and often superficial, knowledge of the working conditions, and are, therefore, impractical, while deserving suggestions have lacked the support of the intelligent and persistent efforts of a strong organization.

The business of a city may be likened to that of a large corporation and the general system, together with all the details for conducting the affairs, must be devised by the practical men in charge of the various branches, if proper and practical results are to be secured.

The operation of a railroad system is acknowledged to represent the highest development of the skillful, able, economical and safe administration of corporation interests. The general plan of operation is in use by both large and small railroads with the detailed methods adjusted to suit each condition. This almost perfect system of corporation administration in its general outline, together with the local details, did not originate with the fault-finding stock-holder, bond-buyer or patron but the entire machinery to the smallest detail was designed, constructed and set in motion by the practical men in charge, from the general manager to the section foreman.

The members of this society have been placed in charge of the business of the various city corporations, and if improvements are to be secured the plans must emanate from these men, having a thorough knowledge of the defects acquired by daily contact with the existing conditions. But after proper and satisfactory modifications have been devised it will require extended, united and organized effort to place them in operation. This society was organized for furthering such ends, and the annual conventions furnish the best means for consultation, education and dissemination of information along these lines. The successes secured by the society in the short period of six years presages an improvement in the more pronounced defects in the near future, with a later thorough reconstruction after the most advanced and suitable plans.

It must not be forgotten in the consideration of American municipal methods that the importance of such questions is governed by the number of people living in cities, the ratio of the urban to the total population, and the size of the principal cities. The development of cities in America has been exceedingly rapid, and it is within a comparatively short period since they have been of sufficient importance to render the defects of government and administration a factor of much general importance. The rapid increase in urban population seriously complicates the municipal situation, and renders frequent changes of plans necessary. The ratio of the population in cities to the total population determines the importance of city interests, while the size of the cities indicates the number and complexity of the questions requiring settlement.

SCENE IN BLATZ PARK, MILWAUKEE.

VIEWS IN JUNEAU, MITCHELL AND LAKE PARKS.

In 1790 there was 3.35 per cent. of the total population living in cities of 8,000 inhabitants or more. At this time there were only thirteen cities having a population of 5,000 or more, and none having 40,000 inhabitants. The percentage of people living in cities increased rapidly, and in cities of 8,000 inhabitants or more there was in 1800 3.97 per cent.; in 1820, 4.93 per cent.; in 1840, 8.52 per cent.; in 1860, 16.13 per cent.; in 1880, 22.57 per cent., and in 1890, 29.20 per cent. In the period from 1790 to 1890 the total population of the country increased from 3,929,214 to 62,622,250, or about sixteenfold, while the urban population in cities of 8,000 or more inhabitants increased from 131,472 to 18,284,385, or about 139-fold.

These figures indicate the rapidly increasing importance of municipalities and the necessity for adopting the most modern methods in the conduct of their enormous interests.

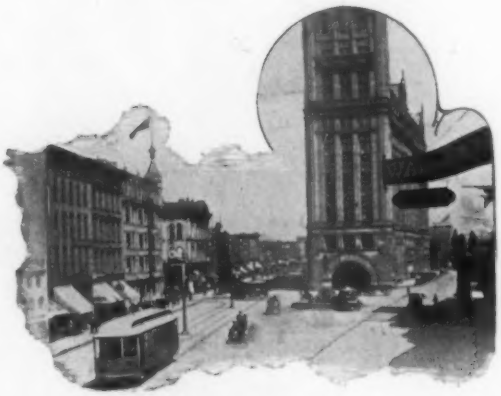
The taking of the census during the present year has directed public attention to the growth of our cities, and from the data available at this time it appears that the past rapid increase in the number of people going to the cities has been fully maintained during the last decade. The increase in population in the cities from which returns have been compiled varies from fifteen to sixty per cent., and it is probably fair to assume the general increase in city population will average between twenty and twenty-five per cent.

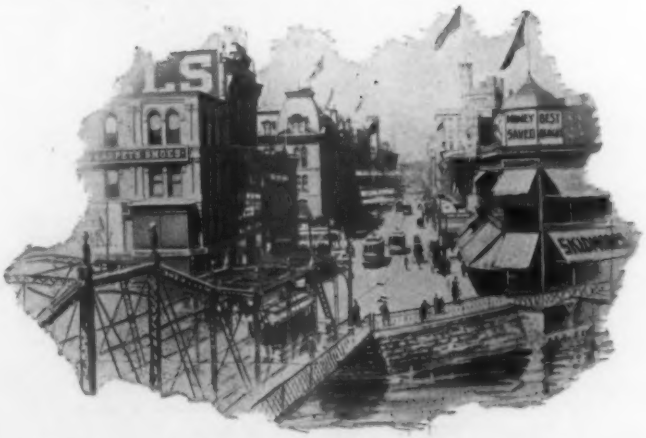
Mr. George Tucker, in writing of the progress of the United States in population and wealth, sums up the importance of the growth of cities in the following language: "The growth of cities commonly marks the progress of intelligence and the arts, measures the sum of social enjoyment, and always implies excessive mental activity, which is sometimes healthy and useful, sometimes distempered and pernicious." This activity has in nearly all instances been progressive in character, but there have been numerous instances, many of them recently, where the growth of a "distempered and pernicious" mental activity has culminated in deeds by the people that are a disgrace to the country.

It is interesting to note that in this inclination of the people to congregate in cities prevails in the principal countries of the world, many of which have a far greater ratio of the population residing in cities than obtains in America, as shown in the following figures giving the percentages in 1890 of the total population of the principal countries living in cities of 10,000 or more inhabitants: England, 62; Scotland, 50; Australia, 42; Belgium, 34; Saxony, 34; Netherlands, 33; Uruguay, 31; Prussia, 30; United States, 29; Argentine, 27; France, 26; China, 25; Denmark, 23; Spain, 22; Italy, 20, and Russia a little over 9. These figures show the United States to rank ninth in this respect, while the countries of limited area have the greatest percentage of people living in cities and are the ones where most attention has been devoted to municipal matters.

COURT HOUSE, MILWAUKEE.

The importance and number of the questions to be settled by a city increase with the size of a city, with a rapidity that almost makes applicable the principles of a geometrical ratio. A place of 1,000 inhabitants can exist nicely without pavements, sewers, electric lights, garbage collection and disposal, street railways, conduits or elevated railways. But if the people from fifty, one hundred or five hundred such villages be placed in one confined urban dis-





VIEWS ON MILWAUKEE STREETS.

trict these former superfluities, together with hundreds of others with their entailing questions of privileges, franchises and regulations, become absolute necessities for the conduct of business and the preservation of health. New departments are created, offices multiply and the character of the city and the people undergoes complete transformation.

This meeting marks the close of the sixth year since the organization of this society, the first association of national importance devoted to the consideration of city affairs. The printed proceedings of each convention show in the best possible manner the high character and great extent of the work performed at the annual meetings, while no small portion of the popular interest in city affairs throughout America is due to the untiring efforts of the officers and members along this line.

PROSPECT BOULEVARD, MILWAUKEE.

At the time of our first meeting the ordinary citizen lacked confidence in any good resulting from a gathering of city officials which was supposed to furnish an excuse for a junket at public expense. It has remained for this association, by the clean and business-like conduct of its affairs, to overcome this prejudice, and prove by example that American public servants are earnestly striving to secure a betterment of the present municipal system. The society is to be congratulated upon its business methods and freedom from all intimations of junketings or waste of time. Many betterments have resulted from its efforts, and the future promises more material results along lines now receiving consideration.

Municipal improvement is the particular department which the association was organized to consider, but it has always embraced other legislative and administrative functions particularly relating to city government, taxes and assessments, and much of the best work has been along these lines. The effort made during the past two years to secure uniform municipal records together with a collection of municipal statistics by the national government, deserves the utmost encouragement, and should be continued until crowned with success. It has appeared to me much good might result by the committee on city government devising a model plan for the government and administration of city affairs, and I would recommend that this question receive consideration by the new committee.

The work of the society has covered city questions so completely and has been performed so thoroughly there is but slight opportunity for suggested improvements. The question of branch organizations has suggested itself and is worthy the serious attention of this meeting. An association, national or international in character, is necessarily confined to the consideration of general principles and questions of general interest. There is neither time nor inclination to devote to the affairs affecting individual localities, which are frequently of greatest moment because affecting the interests of the community more directly. A proper consideration of these questions can only be accomplished through the medium of local organizations. If such local organizations were operated under a central directing power their effectiveness would be materially increased while the central organization would be strengthened in number and influence. I would consider it good policy, therefore, for this society to organize district or state branches with annual gatherings to promote the work undertaken in the interests of municipalities.

It seems probable that the influence of the society might be somewhat strengthened and extended by the removal of cer-

A VIEW OF MILWAUKEE RIVER.

tain restrictions now in force relating to the eligibility of certain individuals to become members. Such membership is now limited by the constitution to persons who have charge of, or supervision over, or are employed, as consulting engineers, on any public or municipal department work. This stipulation bars those persons deeply interested in city affairs, but who may not be connected in any manner with a department of the city. It would appear wise to modify the membership requirements to admit all persons of proper standing who are interested in municipal affairs.

An earnest effort has been made the past year to promote the interests of the association and secure the affiliation of all cities in America interested in such work. To this end circulars and pamphlets giving full information regarding the society were printed and distributed, while the United States and Canada were divided into districts, each of which was placed in charge of a member to develop an interest in our work. The results of such work may not appear during the present year, but it has certainly been very beneficial, and should by all means be continued.

My efforts in all matters relating to the interests of the society have been warmly seconded by the officers and members. I desire to thank the officers and members of committees for their support and also to particularly express my obligation to the local Milwaukee committee, to those members who so willingly assumed charge of the districts for promoting the interests of the society and to the authors of the papers to be presented at this meeting. Whatever success may attend this meeting is due to the local committee and the ready and hearty co-operation of the members and officers and their willing assumption of the duties requested.

The secretary, D. L. Fulton, reported his receipts for the year, showing a healthy condition of the society, and also showed the interest taken in the society by those not already connected with it.

The treasurer, F. J. O'Brien, reported receipts of $770, which had been expended with the exception of $43, in printing report, advertising matter and stationery. The financial condition is very satisfactory. More has been spent in advertising its work, by way of circulars and letters, than ever before, evidently with good effect. Its good work needs but to be known to be appreciated and its benefits desired by other municipalities. The executive committee reported its approval of the secretary's and treasurer's reports.

GROTTO IN FOREST HOME, MILWAUKEE.

The report of the special committee on municipal data was presented by the chairman, Charles Carroll Brown, consulting engineer, Bloomington, Ill.; that of the special committee on municipal statistics, by the chairman, August Herrmann, president of board of water trustees, Cincinnati, O., and a paper on "Uniform Accounting and National Municipal Statistics"

was read by M. N. Baker, New York. These three articles, given in full in this number, take up different parts of the same subject.

A few minutes remaining, a paper on "Methods of Testing Cement for Municipalities," by Horace Andrews, city engineer, Albany, N. Y., was read.

The report of the committee on street paving, by the chairman, Geo. W. Tillson, principal assistant engineer, department of highways, borough of Brooklyn, N. Y., and his paper on "The Construction of Standard Asphalt Pave-

PARK AT WATER-WORKS, MILWAUKEE.

ments," were moved forward from Wednesday morning and read, the business of the convention promising to take all the time at its disposal.

The ladies attending with members were given a carriage ride to the National Soldiers' Home and to Whitefish Bay during the afternoon session, and they were joined at the latter resort at 6:30 by the members of the convention. A surprise in the form of a banquet here awaited them, and contributed much to the sociability of the convention. This seems to be the proper place for such a function. The presence of the ladies added much to the enjoyment of the occasion. Milwaukee added to its reputation for ability in taking good care of visitors at conventions in all respects, and the weather was all that could be desired.

At Wednesday morning's session a paper on "Sewage Disposal and Water Purification" was presented by John N. McClintoch, C. E., of Boston.

In the discussion Mr. M. N. Baker stated that the first septic tank was described in French papers in the early seventies and patents had all been anticipated. This brought the statement from Mr. McClintoch that the company which he represents claims patents on double filtration, on combinations of septic tank with single filtration and with double filtration, but their claims had not yet been passed upon by the courts. The general discussion indicated that partitioned tanks caused deposition of sludge in the first tanks, the amount diminishing in each successive tank, but that properly designed tanks would cause complete bacterial action, thus eliminating practically all the sludge. Mr. Cappelen asked

why the mixture of garbage with the sewage in the septic tank would not result in the disappearance of the garbage. No one could report any actual experiments, but Mr. Thompson suggested that the decomposition of the garbage should take place first, thus making the entire process too long.

Mr. Fisher's paper, on "Standard Medina Stone Block Paving," was read by the author.

Attention was called in the discussion to the inequity of requiring guaranty from the paving contractor for settlement of trenches for which he was not responsible. A careful reading of Mr. Fisher's paper shows that his solution of the problem is a practical one, placing the responsibility where it should rest. Mr. Fisher considers Medina stone pavement preferable to granite at the same price.

New members elected were: J. N. McClintoch, Boston; J. M. McCarty, street commissioner, Birmingham, Ala.; H. C. Newcomer, captain of engineers, Washington, D. C.; A. R. Bradley, commissioner of public works, Cleveland, Ohio.

The afternoon was spent in a profitable visit to the plant for pumping flushing water from the lake into the Milwaukee river to dilute the sewage discharged into it and carry it out into the lake; to the pumping station; to a number of small parks of the city, and to the public library.

At the evening session papers were presented by G. Bouscaren, Cincinnati, on "Filtration of Water;" on "Standard Granite Block Pavements," by Josiah Briggs, New York City; on "Standard Brick Pavements, by E. A. Kemmler, Columbus, O.; and on "The Value of Chemical Tests for Asphalt," by W. H. Broadhurst, New York City.

Niagara Falls was selected as the next place of meeting.

The following officers were elected:

PRESIDENT—R. E. McMath, St. Louis.
FIRST VICE-PRESIDENT—Bernard Saunders, Toronto.
SECOND VICE-PRESIDENT—E. A. Fisher, Rochester.
THIRD VICE-PRESIDENT — John L. G. Mason, New Bedford.
CHAIRMAN FINANCE COMMITTEE—Will B. Howe, Concord, N. H.

The program for the sessions on Thursday embraced the report of the committee on sewerage and sanitation by the chairman, W. K. Eldridge, C. E., Lafayette, Ind.; together with papers by Kenneth Allen, of Baltimore, on "The Baltimore Sewerage Problem;" Chas. B. Ball, plumbing inspector, Washington, D. C., on "Sanitary Plumbing in Public Schools;" Gilbert J. Fowler, superintendent and chemist, sewage disposal works, Manchester, Eng., on "Recent Progress in Sewage Purification in England;" E. A. Hermann, sewer commissioner, St. Louis, Mo., on "Sewage Purification;" Dr. W. C. Bennett, chemist, health department, Milwaukee, on "Milk Supply of Large Cities and Milk Inspection."

The program for the following sessions also embraced the report of the committee on city government and legislation, by R. E. McMath, chairman, and "City Government," by F. W. Cappelen, Minneapolis, Minn.; report of the committee on review, by Geo. M. Ames, Grand Rapids, Mich., chairman; report of the committee on taxation and assessment, by Aug. Herrmann, chairman; report of the committee on park development, by Prof. A. N. Talbot, chairman; "Tree Planting on Streets and

R. E. McMATH, St. Louis,
Newly-Elected President of American Society of Municipal Improvements.

Robert E. McMath, of St. Louis, the newly-elected president of the society, was graduated from Williams college. He was born in Seneca county, N. Y., in 1833. From 1859 to 1862 he was deputy surveyor of St. Louis county, Mo.; from 1862 to 1865 he was a member of the United States coast survey corps, and in the last-named year assisted in running the transit route across Nicaragua. From 1866 to 1879 he was a member of the United States engineer corps and had charge of the improvements of the Mississippi river from the mouth of the Illinois to the mouth of the Ohio river. He made a special study of reservoirs for the Mississippi. From 1880 to 1883 he was a member of the Mississippi river commission; from 1883 to 1891 a member of the board of public improvements of St. Louis. He has been twice elected president of this board, which position he now holds.

Boulevards in Large Cities," by E. C. Lydon, secretary Milwaukee park board.

Most of the papers appear in full in this number of MUNICIPAL ENGINEERING, but others will be published hereafter.

SOME OF THE PEOPLE WHO WERE PRESENT.

The register on the second day showed the following persons were in attendance, although others were expected later:

ALLEGHENY, PA.—D. L. Fulton, superintendent of highways and sewers.

CLEVELAND, OHIO—Arthur A. Bradley, commissioner of public works.

COLUMBUS, OHIO—E. A. Kemmler, assistant city engineer.

CONCORD, N. H.—W. B. Howe, city engineer.

DULUTH, MINN.—Thos. F. McGilvery, city engineer.

GRAND RAPIDS, MICH.—Jos. Emmer, board public works; L. W. Anderson, city engineer.

INDIANAPOLIS, IND.—W. P. Cosgrove, MUNICIPAL ENGINEERING MAGAZINE.

LAFAYETTE, IND.—W. K. Eldridge, C. E.

MILWAUKEE, WIS.—G. H. Benzenberg, consulting engineer; Frank Mezorowski, board public works; D. B. Bush, V. J. Schoenecker, Charles J. Poetsch, E. M. Schnengel.

MINNEAPOLIS, MINN.—F. W. Cappelen, consulting engineer.

GRAND BOULEVARD, MILWAUKEE.

BIRMINGHAM, ALA.—J. M. McCarty, street commissioner; Julian Kendrick, city engineer.

BLOOMINGTON, ILL.—Charles C. Brown, consulting engineer.

BOSTON, MASS.—J. N. McClintoch, C. E.

BURLINGTON, IOWA—Emmet Steece, city engineer.

CINCINNATI, O.—Aug. Herrmann, commissioner water-works; G. Bouscaren, chief engineer water-works; C. T. Christie, mayor's secretary; W. B. Melish, commissioner water-works; M. F. Freiberg, commissioner water-works; C. M. Holloway, commissioner water-works; L. Markbreit, commissioner water-works; Robert Allison, board public service; Sam Weil, Jr., board public service; Wm. Magley, board public service; Wm. C. Johnson, board public service; M. A. McGuire, board public service.

CHAMPAIGN, ILL.—A. N. Talbot, consulting engineer.

CHICAGO, ILL.—D. W. Mead, civil engineer; B. J. Ashley, consulting engineer.

NASHVILLE, TENN.—J. L. Kennedy.

NEW BEDFORD, MASS.—John L. G. Mason, board public works; Wm. S. Cook, clerk board public works.

NEW YORK, N. Y.—M. N. Baker, Engineering News.

NIAGARA FALLS, N. Y.—E. D. Very, city engineer.

NORTH ADAMS, MASS.—John H. Emigh, city engineer.

OSWEGO, N. Y.—F. J. O'Brien, superintendent public works.

PEORIA, ILL.—A. D. Thompson, city engineer; Joseph Elder, commissioner public works.

ROCHESTER, N. Y.—Geo. A. Hotchkiss, superintendent water-works; E. A. Fisher, city engineer.

ST. LOUIS, MO.—R. E. McMath, president board of public improvements, and E. A. Hermann, sewer commissioner.

SHEBOYGAN, WIS.—C. N. Boley city engineer.

TORONTO, ONT.—John Jones, street commissioner; C. H. Rust, city engineer.

WASHINGTON, D. C.—C. B. Ball, plumbing inspector; H. C. Newcomer, captain of engineers; Wm. C. Woodward, health officer.

WATERTOWN, WIS.—G. H. Stanchfield, city engineer.

WILMINGTON, DEL.—Harvey J. Wiley, secretary street sewer department; Frank

F. J. O'BRIEN, OSWEGO, N. Y.,
Treasurer American Society of Municipal Improvements.

W. Pierson, street commissioner; Edward F. Kane, plumbing inspector; Leslie V. Christie, assistant secretary street and sewer department; James D. Carter, director street and sewer department.

NOTES.

Among the faithful members of the society present at the meeting were former City Engineers Benzenberg, Brown and Cappelen, whom the vicissitudes of politics have relegated to private life. Mr. Benzenberg was continued in office for twenty-five years, without reference to the city's political changes, but finally a Jacksonian administration concluded that the office belonged to the successful party. Mr. Benzenberg is to be congratulated upon his change of occupation, for he is now in better, and doubtless more lucrative, employment as a consulting engineer. Messrs. Brown and Cappelen have had shorter experience as city engineers, but would doubtless make similar reports. Municipal work is not attractive, except as a method of securing some valuable experience, under present methods of control and rates of compensation.

J. L. Kennedy, former treasurer of the society and president of the board of public service in Nashville, Tenn., also looked in upon the convention. He also has withdrawn from the field of politics in municipal works.

Twenty-seven cities were represented in the first day's sessions by members of their municipal departments or by consulting engineers

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on municipal works residing in them.

In the discussion of Mr. Tillson's paper on "Standard Asphalt Pavement," it was shown that the standard so far, as gutters for asphalt pavements, is some harder material. Peoria uses an 18-inch cement gutter, combined with curb. Minneapolis uses a 3- to 4-foot gutter of paving brick. Toronto uses cement concrete, 18 to 24 inches wide.

Mr. Herrmann proposed an important amendment of the constitution by adding the words, "or any person of good standing who may be interested therein," to Article II, and making the other changes necessitated thereby. This amendment was adopted, and will doubtless tend to increase the membership of the society. The change was made desirable by the number of competent workers in fields adjacent to that of municipal officials, who were excluded under a strict construction of the constitution.

REPORT OF COMMITTEE ON MUNICIPAL DATA.

By Charles Carroll Brown, M. Am. Soc. C. E., Chairman.

The committee's report to the convention of the society last year initiated an interesting discussion upon the subject, which resulted in the adoption of one of its recommendations and the appointment of a committee to interview the census officials and discuss with them the several questions involved, which are of special interest to this society. A progress report will be presented by that committee at this meeting, since the consideration of special investigations by the census bureau along these lines has been postponed for a year or two.

LAYTON ART GALLERY, MILWAUKEE.

It was the desire of the chairman of this committee and of the president to appoint members of the committee this year with special qualifications for filling in the blank spaces in the forms for uniform reports of municipal operations, such as street lighting, street cleaning, garbage collection and disposal, etc. For personal reasons one appointee could not serve, a second has, I believe, withdrawn from the society, and a third failed to reply to letters addressed to him both by the chairman and by the president. The blanks are therefore unfilled, the chairman being of the opinion that satisfactory forms can be prepared only by those who have had full and varied experience in practice in these lines. This report will therefore attempt to show the portion of the question of uniformity of municipal action which the committee was appointed to consider, and the relations of the various questions which were raised in last year's discussion to this particular part of the subject. Mr. M. N. Baker presents a paper upon the larger questions related to that in charge of this committee, which throws additional light upon it.

There has been a strong movement among the theorists in municipal government, and some efforts among practical managers of municipal details, toward uniformity in all lines of municipal activity, from uniformity in charters, as proposed in the municipal

program recently issued by one of the societies engaged in the study of municipal problems, to uniformity in methods of presenting information in annual reports, as formulated to some extent in the reports of this committee. These efforts all have the same original basis. Our systems of municipal government have, almost without exception, developed in a haphazard way, with only such advances toward scientific organization and control of conditions as have been made from time to time when competent and public-spirited men have been placed in position to insure the application of their theories to the forms of government in the municipalities in which their interests lie. The infrequent combination of competence, public spirit, power and honesty in this portion of the political field makes these advances sporadic and liable to reversal, but the fact remains that they are made.

The economic development of the country has reached such a stage that the universal extravagance in municipal operations is recognized, and the necessity of checking it is daily becoming more apparent. The successful application of the more advanced ideas in municipal government in a few instances leads the political economists to hope that they can be extended to other cities. Difference in physical conditions, in ideas of the relations of state and municipal government, in forms of procedure as crystallized in the development of the various states, have been excuses for refusal to consider changes in methods of procedure, but, after all, the fundamental principles of government are the same in all states, and the latest programs of municipal progress are in such form that most of these superficial differences can be ignored.

When we consider the details of municipal government these differences in methods of procedure seem to be relatively of more importance, and changes to any proposed uniform system seem in some cases to be all but impossible. Perhaps in some cases they are impossible until, by the adoption of the uniform system of city government proposed, a complete revision of methods of manipulating details is forced upon the officials. Some exceptional cases will be found in attempting to apply any proposed uniform method of accounting or reporting under the present conditions. But the very fact that such cases are exceptions will be an argument to aid in improving the general form of government of the city.

The ideal system of accounting, the ideal form of report, is the one which gives all the information necessary to enable the interested citizen to trace the progress of the money he pays in taxes through all the departments of the city government until it finally disappears from the city treasuries, and to form an estimate of the economy with which it is managed, by means of comparisons with the results in other years and with those in other municipalities. There are two reasons for the failure of systems of accounting and reporting to attain to these ideals. One is the development of the system by persons ignorant of the principles of accounts. This frequently occurs in the smaller municipalities and is continued as they become larger, because, second, the impossibility, under such systems of recording expenditures makes it possible for dishonest officials to fill their own pockets or those of their party friends without fear of detection, or at least of punishment.

Uniformity in municipal reports is much more nearly possible of realization than

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uniformity in municipal accounting. If the system of accounting approaches the ideal all the information desired in a complete report can be obtained from the books. If the uniform schedule for such reports is properly prepared, all the items contained in it can be filled in from any such set of books. The nearer the system of bookkeeping approaches the form of the schedules, the easier the work for the bookkeeper. But it is not impossible for the keeper of any such set of books, containing all the information which a system of municipal accounts should contain. Here again, the impossibility of filling out the uniform schedules will call attention to the defects in the municipal bookkeeping and will open up to the light many concealed mines which have long furnished stolen gold to the operating political party. The word "stolen" is used purposely, though many city officials would strongly resent the term as applied to their methods of needlessly increasing the city pay-rolls or adding extras to contracts to reward party services. All the objections to uniform systems of reports will be found to be based on the fact that publicity will prevent this sort of thing and upon the inertia of bookkeepers who denounce as impracticable anything which will add a few hours' labor to those which they now while away in the city's service.

The necessity for expert aid in preparing such schedules for uniform reports is evident. And their full and free discussion is essential that they may conform to as many systems of accounting as possible. The schedules presented by this committee, as stated in its first report at Washington in 1898, are presented as the basis for discussion and formulation. No committee of three can hope to present sets of schedules which are perfect. What this committee has been begging of the members of this society is discussion and criticism of the forms presented. Thus far its prayers have not been answered except in the most general way in the discussion at the Toronto meeting last year. The schedules are still on file and are printed in the report of the Washington meeting. They are again presented as part of this report.

The American Water Works Association and the New England Water Works Association have presented schedules for water reports, the Society of Electrical Engineers is discussing uniform systems of accounting in electrical plants, the American Society of Civil Engineers is asking for national collections of municipal data on a uniform system. Would it not be advisable to combine with these societies and with others who may become interested and thus secure the expert assistance of their members? We recommend the appointment of a committee of conference to secure consideration of the subject by the various societies interested in the details of municipal accounting and the assistance of the societies considering the larger subjects in municipal government which are influential in determining the form of details.

A summary of the principal points discussed at the last convention may be in order as a part of this report.

As then stated, Mr. Carroll D. Wright, the United States Commissioner of Labor, has been engaged upon investigation of municipal management of water works and electric light and power stations. The results are given in a report just issued from the press. Mr. Wright kindly furnished the committee with an advance set of these forms. A comparison of his water works schedules with those prepared by this committee has been made. The Labor Bureau of the State of Illinois has included in its last report the results of an investigation, presumably undertaken in co-operation with Mr. Wright, giving the data secured in that state. This committee is well satisfied with the results of the comparison mentioned. The department schedules are even more detailed and extended in some of the less important details than are the committee's schedules. It seems that there has been some difficulty in some cases in securing satisfactory answers to all questions. This is to be expected, whatever form is adopted, until the movement toward uniformity has become widespread. But the schedules can be filled from any properly kept set of accounts. Thus Newark can answer all the questions in the committee's schedule by taking a little trouble. Cincinnati can probably answer them directly. Perhaps Newark could answer Mr. Wright's schedule questions more readily than Cincinnati could. The exact form of the schedules is not of so much importance provided they call for all the information needed.

Those presented by the committee are the result of extended investigation of existing forms of reports and the adoption of what are considered the most valuable ideas of each, care being taken to include, as nearly as possible, all items of importance in arriving at a decision regarding the economy of management of the works. The fact is that the schedules are not so elaborate as some of those discussing them seem to think. A careful study of them will show that all the information will be contained in the answers to seven of the schedules:

1. General Statistics.
2. Bond Statement.
3. Cost and Valuation of Works.
4. Annual Receipts.
5. Annual Disbursements.
8. Water Pipes in Use.
11. Cost of Pumping.

These seven tables are not quite as elaborate as the corresponding tables presented by the Department of Labor. They are more elaborate than those proposed by the American Water Works Association and those

of the New England Water Works Association, and used by a dozen or so of water works superintendents in preparing their reports. They are so only because they cover more ground and cover it more thoroughly. And they are made so because experience in collecting and comparing data from various cities has definitely shown that the greater detail is necessary in order to meet the legitimate demands of engineers and others in investigating the questions arising in the financial and technical management.

Schedules 6, 7, 10, 12, 13 are comparative statements, of which three are made up of the data given in the other tables for successive years, and the other two, 10 and 12, go somewhat more into detail in pumping records or consumption of water. The balance sheets of Cincinnati and Erie are simply suggestions, deemed of sufficient interest to warrant presentation. They contain no information not contained in the other tables. No system of water works would use all the tables. They are intended to cover as nearly as possible all conditions, and selections must be made by the individual superintendents of the tables suited to his particular system. An examination of Mr. Wright's tables will show that they call for all the information contained in the seven primary schedules of this report, and also for considerable description of details of construction, payment, etc., which should be contained in the official reports of new construction and are not subject to material change from year to year and therefore are not needed in schedules for annual reports. The first schedule of the committee's report contains a summary of such information, reference to be made to such detailed descriptions when additional information is required. The greater detail of Mr. Wright's schedule in these general matters is advisable in a single investigation like his or in a census inquiry, made once in ten years.

A practical application of one of the forms, "Cost of Pumping," was made in a table comparing the cost in a number of cities for a number of years, printed in the proceedings of the Ill. Soc. Eng. and Surv., 1899. This form is based upon one used by Mr. E. Kuichling, when chief engineer of the Rochester water board, some years ago in a similar investigation. It has thus twice demonstrated its value. The great labor involved in reducing the data given in the reports of the cities named in the tables to the uniform standard required for them demonstrates the differences in methods of accounting, and the fact that it could be done demonstrates the possibility of securing uniformity in reports even with material differences in methods of accounting. The impossibility of constructing similar tables for many cities whose reports were at hand show the need for the adoption of uniform schedules for reports, that those cities having defective forms may have expert guidance in correcting their many errors of omission and the smaller number of errors of commission. In a commercial way an effort toward uniformity of accounting has been made by the company publishing Municipal Engineering Magazine. As a result of a competition instituted several years ago for the best forms of keeping water works accounts, this company devised a system of books and cards for keeping the records of the smaller water works companies, and has placed the system on sale, with the result that a large number of water works companies are now using these uniform systems of accounts. The schedules presented by this committee can be filled without difficulty from these books. A similar competition by the same company for electric lighting plants has just been held and this committee has had an opportunity to study the forms presented. The failure to secure an expert in this line as a member of this committee has prevented the presentation of schedules for reports.

Too strong emphasis can not be put upon the necessity for the adoption by competent authority of approved schedules for uniform reports. It is not probable that more than one or two cities could use any set of schedules that could be presented without some extra work in arrangement and combination of items. The agitation for uniformity has shown this, and the possibility of the adoption of uniform schedules discourages the use of any of those which have been proposed, until they have the weight of more authority, especially when considerable labor is necessary to fill them or the methods of keeping accounts must be changed. This is natural, since another change might be necessary when the authoritative schedules are finally adopted. This is probably one reason for the failure to use the water works schedules proposed by the two water works associations. Another probable reason is found in the fact that the schedules presented by them are not exhaustive. They are tentative forms, presented as the nearest approach to what could be obtained in the way of information at the time they were prepared. The only way to get what is wanted is to put the schedules in complete form, give them all the authority possible by society and census department adoption and then induce their acceptance by continued agitation and discussion. The advocates of uniform accounting, uniform charters, etc., will all aid in the lesser subject of uniform reports, to which this committee has been restricted. This part of the work can be done in a way independently of and in advance of the greater work.

If the societies interested can be brought together to adopt such uniform systems of reports, there will be much more rapid advance toward uniformity in reports, and this will be a great aid in securing uniformity in accounts. The various societies are expert in various lines and must be depended upon to prepare the schedules in which they are most directly interested. This society is interested in the fields covered by the schedules presented by this committee in particular, and a full discussion and revision of the committee's schedules and a recommendation of the forms finally approved to the joint committee will tend to hasten action. And if our efforts are to have their full effect upon the census bureau, action can not be longer delayed. Detailed study and discussion of the schedules is therefore recommended as the basis for amendment and adoption. The fact that they have been before the society for two years should insure sufficient familiarity with them to make such discussion easy and such immediate amendment and recommendation advisable.

REPORT OF SPECIAL COMMITTEE ON MUNICIPAL STATISTICS.

The special committee appointed at the last annual meeting to take up with the census authorities the matter of municipal statistics submitted a report in which was reviewed previous action by the society and a communication addressed to the government officials, together with answers received from them. The latter embraces a letter from Fred H. Wines, assistant director of the census, stating that the great desire of congress at the present time is for what they call a "quick census," and the immediate census inquiries therefore are limited to four branches, viz., population, mor-

AUG. HERRMANN,
Chairman Committee on Municipal Statistics.

tality, manufactures and agriculture. The other inquiries are postponed until the report upon these subjects shall be ready for publication. In 1902 a division of the census office will be organized for the purpose of entering with vigor upon the examination of subjects relating to municipal life, and Mr. Wines says that the department will then be glad to have the co-operation of the American Society of Municipal Improvements in the formulating of plans and in the selection of the proper person to take charge of the work. In commenting upon this letter and the law governing the census department the committee says:

While your committee has felt that it would be preferable to have this work done through the census department, if possible, two very serious objections present themselves. First, the matter of delay, and second, whether the law under which they were to act, would be explicit enough for the purposes desired.

Your committee also desires to call attention to the fact that by a recent act of congress, the Department of Labor is now required to publish an annual volume on statistics of the larger American municipalities. The question presents itself whether it would not be advisable to take this matter up with that department. It seems that the committee appointed by the American Society of Civil Engineers has already taken steps in this direction. Mr. Whinery of that committee in a communication to the chairman of your special committee, writes as follows:

"I have heretofore felt, with you, that it would be preferable to have this work done through the census department. It is evident, however, that to do this work satisfactorily would require additional legislation and probably a further appropriation, both of which may be difficult to procure within a reasonable time. I believe that the more we study the question, the more evident it becomes that to prosecute this work of census of public works in a proper manner, we must have a permanent census bureau. This question of a permanent census bureau has been agitated for thirty years, and has been pressed upon congress a number of times with great energy. There are objections to it which seem difficult to overcome. Furthermore, the census department of the government has always been dominated, more or less, by politics, and its work from a scientific standpoint has always been open to criticism, due, no doubt, to its hasty methods and its lack of scientific organization.

"It is true that the delegation to the Labor Department of the duty of collecting statistics of public works is somewhat anomalous But in this department we have a permanent organization on a quasi-scientific basis, and practically free from politics. At the head of it is a commissioner, trained in the collection, digestion and collation of industrial statistics. A slight amendment of the law under which the department is operated and a liberal appropriation for the purpose, would put the Commissioner of Labor in a position to do exactly the work we are seeking to have done.

"In view of all this, it seems to me that

we are more likely to secure the interest and active co-operation of the Department of Labor than of the census bureau in the work we desire to accomplish; that it will probably be much easier to secure the slight amendments and the appropriations from congress necessary to put the Labor Department in a position to undertake the work than to secure the establishment of a permanent census bureau with suitable enlargement of its scope and the necessary appropriations; and that we are more likely to secure the doing of the work in a thorough and scientific manner by the Labor Department than by the census department.

"I shall be glad to have your further views on the subject. If, after mature consideration, it is thought best to direct our efforts to the Commisisoner of Labor, I am of the opinion that a personal interview with him, in which the whole matter could be discussed, the necessary amendments to the present law formulated, and the amount congress should be asked to appropriate determined upon, would be the quickest and most certain way of getting this movement started. If we are to accomplish anything with the next session of congress, there is no time to be lost."

Your committee is of the unanimous opinion that the matter should not be dropped at this time, but that renewed efforts be made to secure the results desired.

While it is true that a number of the states have taken this matter up, and adopted laws pertaining thereto, no two of them seem to have the same laws, and the result will be that no uniform statistics will ever be secured until it is done in some systematic and uniform manner by the government.

In conclusion your committee makes the following recommendations:

First—That a special committee on this subject be again appointed by the president for the ensuing year.

Second—That the committee, when appointed, shall at once co-operate with similar committees appointed by the American Society of Civil Engineers, together with the secretary of the National Municipal League, and such other committees as may have already been appointed on this subject.

Third—That this committee shall also be directed to call the attention of all societies, devoted wholly or in part to municipal affairs, having their annual conventions during the ensuing year, to this subject, and request them to appoint similar committees.

Fourth—That this committee shall be directed to communicate with the Commissioner of Labor relative to any change of the laws that may be necessary to bring about the results desired.

Your committee also recommends that if, after a conference with the Commissioner of Labor, or the committees appointed by other organizations, it is found necessary that congress be appealed to for new or additional legislation, that then the committee should be directed to notify the various members of the society thereof, with a view of having each of them obtain the indorsement of their respective municipalities to any memorial that may hereafter be presented to congress on this subject. All of which is respectively submitted for your consideration.

August Herrmann, Chmn., Cincinnati, O.
A. D. Thompson, Peoria, Ill.
Chas. C. Brown, Bloomington, Ill.
Dr. W. C. Woodward, Washington, D. C.
M. R. Sherrard, Newark, N. J.
Committee.

THE CONSTRUCTION OF ASPHALT PAVEMENTS.

By George W. Tillson, M. Am. Soc. C. E.

Just thirty years ago the first asphalt pavement was laid in this country at Newark, N. J. At that time nothing was known of the durability or the proper methods of construction of a pavement of asphalt. A great many experiments and trials were made in laying such pavement during the next fifteen years, actual records being kept of the methods employed, so that proper calculations could be arrived at as to the proper construction. At the present time, however, the irregularity of laying an asphalt pavement has been standardized, and one can say, with comparative certainty, what is the best method of construction.

In order to make a good asphalt pavement the material should be good; it should be properly mixed, and well laid on a good foundation.

Although all pavements require a good foundation, with asphalt it is absolutely essential, as the asphalt itself has no inherent strength but simply serves as a cushion to transmit the load to the base which must sustain the weight.

Pavements have been laid with comparative success over wood, cobblestone, granite and Belgian block pavements as a foundation, but at the present time it is conceded that a cement base of proper materials and thickness, according to the traffic, is the best for all conditions. It is not proposed, however, to enter into a detailed account of the construction of the concrete base, as that will be the same for pavements of all character.

The original asphalt pavements consisted of a wearing coat two inches thick, and cushion coat one-half inch in thickness. The cushion coat was first laid and rolled, and the wearing coat then laid upon it. This did not give general satisfaction, as if the base contained moisture to evaporate, and the escaping steam lifted the cushion coat from the concrete, forming bubbles, so that it was difficult to make the asphalt adhere

to the base, and, also, in many cases to prevent the wearing coat from slipping on the cushion coat. To obviate this difficulty it was deemed best to lay a binder of so-called "binder course" upon the concrete. This binder course consisted of broken stone, in size from an inch in diameter down to that which would pass through a ten-mesh sieve cemented or held together by asphaltic cement. This binder has been laid of different thicknesses, but as its object is not to form a portion of the pavement proper, but simply to act as a medium to connect the wearing surface to the concrete, the least thickness that will do this is sufficient. One inch has been successfully used, and that is considered standard at the present time. although some cities use a binder coat one and one-half inches in thickness; but, con-

GEO. W. TILLSON, M. Am. Soc. C. E.,
Chairman of Committee on Street Paving.

sidering the principles spoken of above, there does not seem to be anything gained by the extra half inch.

In considering the wearing surface it must be remembered that an asphalt pavement is a bituminous concrete with the particles of the sand held together by the asphaltic cement. Asphalt itself may be defined as any hard, natural bitumen, or any material bearing such bitumen in any appreciable quantities. The bitumen forming the asphalt has been considered by chemists to be divided into two parts, petrolene and asphaltene, or, as some choose to call it, active and inert properties. That portion of the bitumen which is soluble in petroleum ether is generally considered to be petrolene, and the remainder, or the quantity soluble in chloroform, or carbon-bisulphid, is considered asphaltene. The former is the active and valuable part of the product; while the latter is of no particular value.

Whether an asphalt is suitable for a pavement or not is hard to determine by any examinations, whether chemical or physical. All bitumens do not make good pavements. A practical common-sense method of testing a new asphalt, while perhaps not scientific, would be to take some standard asphalt, like the Trinidad or Bermudez, and make careful physical and chemical examinations of it, and then make similar examinations of the proposed asphalt and then compare results. In this way probably would be obtained the most satisfactory conclusions regarding the new asphalt, but the only sure test is to test it in the pavement, and then safe conclusions cannot be drawn until after a lapse of two or three years.

No asphalt as it is put on the market will make a good pavement without some treatment. It is either too hard or too soft, and must be fluxed with some other bitumen in order to bring it to the proper consistency. This material, after being fluxed, is called asphalt cement. As a rule, the asphalts in use contain too little petrolene and are fluxed with petroleum residum or maltha, which contains a large proportion of petrolene. The petrolene in the flux acts as a solvent to the hard asphaltene of the asphalt and produces a compound which has more cementitious values than the original asphalt. The quantity and amount of flux to be used depends upon the character of the asphalt and the character of the flux.

Just what is the best material for these fluxes is at present a mooted question. The greater portion of asphalt pavements that have been laid in this country, and those that have made it a success, have been laid with petroleum reiduum as a fluxing agent. It is claimed by some, however, that this being a volatile substance, the pavement does not last as long with it as it would with a flux that is more stable. Maltha and asphaltic oils have been used by those who are opposed to residuum, and with good results. It is certain that either will give a good pavement when properly used, and experience alone can demonstrate whether there is enough difference between the two to be worthy of practical consideration. The hardness of an asphaltic cement is important. The consistency is brought about by the flux. It should be of such a nature as to give a pavement that will not become too soft in hot weather, and one that will not be so hard as to crack in cold weather. To get the mean between the two is important, and sometimes difficult. The exact consistency of the cement is tested by machines, one made by the late Prof. Bowen and the other by Mr. A. W. Dow, the present inspector of asphalts and

cements in Washington. While differing in detail and in numerical results comparatively, they are probably of equal merit. They are both based on the principle of the amount of penetration shown by a needle weighted with a certain amount and resting on the asphaltic cement for a given length of time. The cement must be kept at a regular temperature, and 72 degrees F. is generally taken as a standard. The cement is maintained at this temperature by being kept in water of 72 degrees. The mixture for the wearing surface is made of sand, pulverized mineral matter, and the asphaltic cement just described.

There is considerable difference in the opinion of asphalt contractors as to what size of sand gives the best results, some favoring one that is fine and others one that is coarse. It does not seem, however, that the exact size of the sand is so important as it is that it should be evenly graded so that the voids be as small as possible. A sand whose largest particles will just pass through a ten-mesh sieve, and grading from that down to dust, will give good results. The sand, however, should be of hard, sound mineral matter, free from any organic substances whatever, and the gradations should be even and regular. On account, however, of the difficulty of obtaining such sand as above described the mineral matter is added to assist in the filling of the voids. It is a well-known fact that in all of the concretes when the aggregate is of a hard, durable material the less the amount of voids, the more solid and complete will be the mixture, so that it is important that the amount of mineral matter be properly regulated, the exact amount being determined by the character of the sand. It should be so ground that it will all pass a 30-mesh sieve and 80 per cent. of it should pass one of 100 mesh. This mineral matter when first used was always carborate of lime. This probably arose from the fact that the rock asphalts of Europe are formed of limestone, and it was supposed that by the use of the carbonate a substance approximating the European pavements would be obtained. This would probably be so if the temperature of the mixture was 1,200 degrees or 1,400 degrees, as it would require at least that heat to allow the carbonate to become impregnated with the bitumen. It is probable, however, that the action of the powdered mineral matter is mechanical rather than chemical, and pulverized silica has been used to a certain extent with good results. It is, however, more expensive than the carbonate of lime, and for that reason not used to any great extent. Besides assisting in filling the voids the carbonate of lime also makes the pavement harder. The amount used varies, but ranges from 6 to 10 per cent. The exact quantity of asphalt to be used must depend entirely upon the amount of contained bitumen. Refined Trinidad contains about 55 per cent., Alcatraz 80 and Bermudez 90 of bitumen, and when it has been decided how much bitumen is required in the pavement, knowing the quantity in the asphalt, the proportions can easily be calculated. At the plant the sand is heated to a temperature of about 40 degrees, when it is dumped into the mixing box, the carbonate of line added at once, and after a little mixing the asphaltic cement is also added, the entire operation of mixing consuming about 1¼ minutes.

The asphaltic cement for the binder is generally somewhat softer than the wearing surface, having from 25 to 50 per cent. more flux added in the mixing. The cement and stone are mixed together in about the proportions of twenty gallons of cement to one cubic yard of stone. It is then hauled to the street and laid so as to produce the required depth after being rolled.

The wearing surface is next spread upon the binder in such quantity as will produce the required thickness. The exact depth is obtained more by the judgment of the rakers than by any actual measurement, although, as a rule, 2½ inches of the loose material will compress to 2 inches after thorough consolidation. After being dumped from the cart the material should be raked out smoothly and evenly and freed from all lumps, when it should be lightly rolled with a hand roller, and then covered with a thin coating of hydraulic cement. Another roller of about five tons' weight should follow to give the initial compression, and then the pavement be given its final compression by a roller weighing not less than ten tons, or 250 pounds per inch of width. The object of the different rollers is to give the compression by degrees, so that the weight may be applied vertically in all cases. If a too heavy roller be used at first the material is apt to be pushed ahead rather than compressed vertically, and an unevenness be produced which is very hard to be smoothed out by subsequent rolling. The rolling should be carried on continuously until thorough consolidation is brought about, lengthwise of the street, at first, and crosswise and diagonally whenever the width of the roadway will permit. The amount of rolling required depends a good deal on circumstances, but the rollers above described should have no difficulty in consolidating, under ordinary circumstances, 2,000 square yards in ten hours.

The material should be brought to the street at a temperature of not less than 250 degrees and 280 degrees or 300 degrees are even better, especially if the temperature be cold, as the consolidation must be brought about before the material has become cooled. At just what temperature the

laying of an asphalt pavement should be discontinued is a question that has not been definitely decided. When this has been definitely fixed in specifications it is generally put at about 40 degrees. While it is advisable to lay asphalt at temperatures of 70 degrees or over, good results have been obtained when laid at 10 degrees above, and sometimes at zero, although the practice is not to be commended. In ordinary weather, and with ordinary length of hauls, the temperature of the material will not lose more than 15 or 20 degrees in transit from the works to the street.

It is a well-known fact that the action of water has a deleterious effect upon asphalt. While the advocates of some varieties claim that their asphalt is affected less than others, all cities take special precaution in laying gutters to prevent the action of the water. In some places the authorities go so far as to lay a gutter of some imperishable material, such as brick or granite, but the general plan is to pave with asphalt to the curb; and, while there is no question that there is more decay in the gutters than on the street, the advantage of having the entire street paved with asphalt will offset the small extra cost of repairs in the gutters. In order to prevent, however, the action of water as much as possible, a strip in the gutter about one foot wide is painted with asphaltic cement and ironed with hot smoothing irons. The object of this is to saturate the pores of the asphalt with bitumen, and thus prevent the penetration of the water which produces the oxidation of the bitumen. In doing this, however, care should be exercised not to have the irons too hot; as iron will stand temperatures of perhaps 1,000 degrees before being visible to the eye it would be possible to have the irons so hot as to materially damage the asphalt, and thus add to the disintegrating effect rather than prevent it.

Pavements laid as above described should last ten years with little repairs, and from eighteen to twenty before requiring resurfacing, under ordinary conditions.

THE VALUE OF CHEMICAL TESTS OF ASPHALT MIXTURES.

By W. H. Broadhurst, Chemist, Department of Highways, New York City.

The object of specifications for the manufacture and laying of asphalt pavements being to define and secure final results rather than prescribe certain definite and fixed formulas, the contractor should be allowed some latitude in proportioning the ingredients of the mixture for the wearing surface. Furthermore, asphalts vary largely in proximate composition and each requires special treatment:—hence, to specify limits for the percentage of each ingredient of a paving mixture, suitable both for asphalts which are practically pure bitumen and for those which contain a large percentage of mineral matter, would require so wide a range of formula that the specification would fail of its purpose. In order, therefore, to admit of the use of the numerous asphalts now on the market and of the various grades of sand advocated by different contractors, the specifications now in use for laying asphalt pavements in New York City describe the manufacture of a standard pavement mixture followed by a general clause of which the following is an abstract, viz.:

"Whatever the character of the asphalt used or the manner of manipulation and laying, the pavement obtained shall conform to the following general requirements: The pavement when laid shall be equal in consistency, surface, and durability to the standard pavement made as hereinbefore described. It shall contain no water nor appreciable amount of light oils nor matter volatile at a temperature under 250 degrees F. It shall yield when extracted with bisulphide of carbon and after the evaporation of the solvent, not less than nine (9) nor more than twelve (12) per cent. of pure bituminous matter. All of the mineral matter shall pass a 10-mesh per-lineal-inch sieve, and not less than fifteen (15) per cent. shall pass a 100-mesh per-lineal-inch sieve, while the remainder shall be graduated between these limits."

Such a clause admits of no ambiguity and

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prescribes certain definite requirements which cannot be violated to any great extent, provided the mixture be tested from day to day throughout the course of the work.

Asphalt surface mixtures may be regard-

ed as composed of but two ingredients—cementitious bitumen and mineral particles (sand and mineral dust) graded from coarse to fine so as to reduce the per cent. of voids to a minimum. In examining these mixtures the points to be considered are the quantity and quality of the contained bitumen, and the size and quality of the mineral particles. An asphalt pavement as laid should never contain less than 9 per cent. of bitumen soluble in carbon bi-sulphide or chlorofrom. Any less percentage seriously limits the life of the pavement. Contractors who have long-time maintenance contracts generally use a fine sand and all 10 per cent. or more bitumen. In other cases where future economy is not an object, the mixture is quite likely to run dangerously near the 9 per cent. limit, and this is quite characteristic also of the short-sighted policy of some contractors who lay asphalt under a ten-year guarantee.

The quality of the contained bitumen is the second point to be determined and should always be considered in connection with the consistency and quality of the asphaltic cement before it is mixed with the sand. The following procedure is recommended: A sample of asphaltic cement should be taken from the "works" from day to day and its degree of consistency or penetration determined by use of a penetration machine. An equal amount of bitumen (about five grams) is then to be extracted with chloroform from both the asphaltic cement and the pavement mixture taken from the street, the solvent thoroughly evaporated in each case under the same conditions and the degree of penetration of the bituminous residues determined. That from the street mixture will be harder according to the degree of heat to which it was subjected when spread on the sand. It is readily apparent that the character of the bitumen may be greatly altered by admixture with overheated sand. The treatment which these uncertain asphalt hydrocarbons are required to undergo at this stage in the manufacture of the mixture, is a severe test even at the usual temperature of 325 to 350 degrees F. Each sand particle becomes coated with a thin film of asphaltic cement which is constantly exposed during mixture to the air. If these sand particles reach a temperature of 350 to 450 degrees F. or higher, caused by overheating in the drums, a part of the asphalt oil, or "active bitumen" is driven off and another portion probably converted into "asphaltene." The percentage soluble in petroleum naphtha of the pure bituminous matter in the cement will therefore be considerable less after it has been mixed with overheated sand. The petroleum-naphtha-soluble content of the pure bituminous matter in the cement before and after mixing will therefore give us considerable information as to how far the bitumen has been changed in the process. The writer recently examined samples of a section of pavement which worked very stiff when laid, and which was presumed to have been overheated. The petroleum naphtha and chloroform extractions gave the following results:

	Per Cent. of Total Bitumen in Sample.	Per Cent. of Total Bitumen soluble in Petroleum Naphtha.	Per Cent. of Total Bitumen insoluble in Petroleum Naphtha.
Asphaltic Cement from "Works"	98.12	80.29	19.71
Paving Mixture No. 1.. (Taken from street.)	11.01	73.75	26.25
Paving Mixture No. 2.. (Taken from street.)	9.42	64.96	35.04
Paving Mixture No. 3.. (Taken from street.)	8.66	61.07	38.93

The method of analysis must of course be invariably the same and the figures obtained apply strictly to the cement experimented on, though general comparisons may be made with other cements which contain more or less flux as determined by the penetration. Other things being equal, the more flux a cement contains the greater the percentage soluble in petroleum naphtha. A microscopical examination and mechanical analysis to determine the size and quality of the mineral residue should always supplement the chemical examination. The results of the tests enumerated above are sufficient in the majority of cases to indicate the cause of discrepancies in the manufacture of asphalt mixtures. A few of the more common errors to be guarded against are the following:

1. Deficiency in the amount of bitumen caused by neglect to properly proportion the mixture or from the introduction of sediment into the cement by working the tank too low.

2. Too stiff a mixture caused by overheating.

3. Too stiff or too soft a mixture caused by failure to properly proportion the amount of flux to the asphalt or the asphaltic cement to the sand.

4. Soft spots caused by failure of petroleum residuum to completely dissolve or "blend" with asphalt.

A superintendent of works is not infallible, and if mistakes occur, the mixture is, as a rule, placed on the street notwithstanding, as each square yard of material must be accounted for, and to reject any would mean a loss to the company and an injury to his reputation. There is, hence, abundant opportunity for the chemist to detect errors and advise against failures,

especially in the case of new and inexperienced contractors. Without data covering the points above enumerated, the engineer is usually at a loss to know whether he has the right to condemn an apparently poor mixture. With such data at his command, he is enabled to intelligently criticise the work, point out errors and dictate proportions if necessary.

The point is often made that inasmuch as the contract provides for maintenance of the pavement for five or ten years, as the case may be, the contractor should be allowed to lay the pavement without restriction as to formula. The taxpayer, however, may justly claim that asphalt pavements, when laid with the best materials and under expert superivision, should last for fifteen to twenty years with but few repairs necessary; that the city should not be required to enter into contracts for maintenance of pavements which rapidly disintegrate at the end of the guarantee period; and further, that he should not be compelled to submit to the inconveniences caused by the closing of streets for frequent repairs. For these reasons, if scientific control of asphalt paving by means of frequent analysis and tests secures pavements of comparatively permanent construction—and experience abundantly proves that it does—their value is readily apparent.

CONSTRUCTION OF GRANITE BLOCK PAVEMENTS.

By Josiah A. Briggs, Chief Engineer Department of Highways, Borough of Bronx, New York City.

This pavement may very properly be classed as a standard pavement for city streets, as it meets all the requirements of traffic, applies to any grade, and is, without doubt, the most durable pavement in use. It is a comparatively economical pavement. The only serious objections to its use are, taking all things into consideration, the fact that it is very noisy under traffic and its roughness tends to shorten the life of vehicles. These objections are more or less compensated for by the better footing it gives to the horse in hauling heavy loads.

There are two methods of constructing this pavement, viz.: As a first pavement, on unimproved or light traffic streets, it is generally laid with a sand base or bed, and joints of the same material; then on improved heavy traffic streets, or as a repaving, it is laid with concrete base and sand cushion or bed, the joints of gravel and bituminious paving composition or Portland cement grout.

It is absolutely necessary that the foundation or underlying material should be rendered uniformly firm and unyielding before beginning the work of construction. If the street has been sewered the matter of subdrainage is well provided for; if not, care should be exercised to secure good subdrainage by other means. It may be that excavations have been made for pipes or for other purposes and the openings may not have been solidly filled and compacted; it is, therefore, advisable before completing the forming of the sub-grade to require that a steam roller weighing at least twelve tons be run over the whole surface several times until there is no yielding. This will reveal any soft places and will compact those of shallow depth. If any appear to be of considerable depth it is well to slightly hollow or depress the surface over them, making openings with a bar, then flush with water, letting it flow until the voids below are thoroughly filled and solid. After it is allowed to dry out somewhat, the roller should again be passed over this surface.

In the excavation for sub-grade it is sometimes provided that no ploughing be done; but that seems to be an unnecessary provision where the rolling, above referred to, is required. If no rolling be done then the plowing is objectionable for the reason that it will leave a sub-surface of uneven hardness.

The paving blocks should be hauled upon the work and piled on the sidewalks at least two feet back of the curb, for the length of one or more blocks depending somewhat on the requirements of business, etc., leaving openings for access to buildings, and being careful not to obstruct fire hydrants, mail boxes, etc. After these are delivered and before the final forming of the subgrade, the curbstones on either side of the roadway should be reset to the correct lines and grades, damaged stones to be replaced with perfect ones. The crosswalks at the intersecting and terminating streets should then be relaid on a sand bed and made to conform to finished surface of pavement.

When the blue stone is reset as above, the subgrade should be brought to a true surface uniformly parallel with the proposed finished surface of the pavement and where a sand base is used ten inches below the same. Where a concrete base is laid the subgrade should be sixteen inches below the finished surface of pavement, allowing for six inches of concrete, two inches of sand and eight inches for blocks.

Where concrete-base or foundation is used the concrete should be composed of one part of Portland cement, three parts of clean, sharp sand and six parts of broken stone, or sufficient to make up of the latter the proportion necessary, to cause the voids to be

filled and the mortar to flush to the surface when rammed. If American hydraulic cement be used the proportion should be one part of cement, two parts of clean, sharp sand and five parts of broken stone, the latter to be increased or diminished as may be necessary to secure filling of all voids and flushing of mortar to surface when rammed in place.

The cement should be freshly ground and of uniform quality and firmness,90 per cent. fine when tested in a sieve of twenty-five hundred meshes to the square inch and subject to the following further tests: Briquettes of neat American hydraulic cement having a middle section of one square inch, exposed in air thirty minutes and immersed in water twenty-four hours, should withstand a tensile strain of sixty pounds per square inch; if of American Portland cement, with one hour in air and twenty-four hours in water, they should be required to withstand a tensile strain of 150 pounds per square inch. A further test might be exacted of the Portland, with exposure in air for one day and immersion in water six days; that it withstand a tensile strain of 350 pounds per square inch. More exacting tests than the foregoing are frequently required, but it appears to me that these tests will secure cement of sufficiently reliable quality to answer for this kind of work. The cement when delivered on the work should be carefully piled, on blockings, to keep it off the ground, and thoroughly covered to keep dry.

The broken stone should be good, hard stone, equal to trap, granite or limestone. It must be free from dust and dirt and broken to such size that all will pass through a revolving circular screen having circular holes two inches in diameter and be retained by a screen having circular holes one inch in diameter.

In mixing the concrete without machinery it should be mixed on tight platforms of wood or metal (thin metal is to be preferred) about twelve feet square. Batches containing no more than one barrel of cement with the proper amounts of the other materials are preferable. Mix the sand and cement together dry and spread in a layer; over this distribute the broken stone after it has thoroughly wetted, then turn the mass with shovel and mix thoroughly, adding gradually sufficient water to bring the whole mass to a proper consistency, so that when moved to its place and rammed, all voids wil be filled and the mortar will be flush to the surface. Care should be taken that there is no more mortar than will just fill all voids. If the mixing is done by machinery proper proportions of materials must be secured and a mixture of uniform character and quality obtained. No delay should be tolerated in the mixing and moving into place of the concrete mixture, nor should concrete be used which has been mixed more than fifteen minutes. While being put in place it should be carefully spread and rammed until well compacted and mortar flushes to the surface. In connecting with a batch partially set the face must be broken down and washed clean so that there will be perfect union between the new and old work. As to how much time should be allowed for the concrete to set, that will depend largely upon the kind of cement and the temperature, but under ordinary conditions seven days should be sufficient. This, however, should be a matter of judgment.

Until the concrete is sufficiently set no carting or wheeling over it must be allowed and then only when covered with planks.

The blocks should be of a durable, sound and uniform quality of granite, free from weather marks and seams. The appearance of the pavement is very objectionable if blocks of different color or shade are used, and therefore they should be uniform in color. As to hardness, that is more important still, for the pavement will wear unevenly if blocks of a softer quality are allowed to be mixed in with the harder blocks.

In case the blocks come from different quarries it is desirable to pile and lay each lot of blocks by themselves so that there will be no mixing.

The blocks should be split and dressed so as to be in form as nearly rectangular as possible, measuring on the face or upper surface not less than eight inches nor more than one foot in length. If the blocks are longer than this the cross section of the road-bed will show for the surface a many-sided polygon instead of the desired curve or arch. There is also danger of the breaking of blocks under traffic where the length is out of proportion to the depth. The width should range between three and one eighth and four and one half inches. This width seems to give the best footing for the horse. The depth of the blocks should range from seven inches to eight inches.

When the blocks are delivered on the work careful inspection should be made, and all imperfect stones removed from the line of the work. The contractor should submit several specimen blocks before beginning work, and all blocks furnished should be equal to these, if they have been approved.

When ready to begin the laying of blocks the sand bed or cushion for the pavement is spread evenly over the prepared surface, whether concrete or earth, to a depth of about two and a half inches. This sand should be clean, coarse and free from dirt and large pebbles.

When the sand is spread the bond or guide stones are set by careful measurements from a line stretched between the top of curbs, parallel with and at sufficient

height above the finished surface or crown to allow for ramming. They are set about four feet apart transversely and about three feet apart longitudinally. It is best to work up grade in laying the paving, for the reason that on the steeper grades the front courses of stone are likely to creep or fall away and leave wide joints if they are laid down grade, a condition which it is difficult to remedy.

The blocks must be laid in courses at right angle to the lines of the street, and the stone in each course should be of nearly uniform width. Unless care is observed in this matter the courses will gradually depart from right angles and result in bad work. The angle of the courses with the curb should be frequently tested to keep them in proper range.

Where the street is crossed by another street at right angles or nearly so it is best to range the courses according to the herring-bone method. This will prevent wearing of joints, as it is impossible for traffic to follow the joints in that case. If an intersecting street crosses at an oblique angle of not less than 15 degress from a right angle it is best to pave the courses at right angles to side line as in the sections between street, and the same method should be followed at streets which connect with the street being paved but do not cross over. The stones in the courses should be laid close together so as to break joints with the next course with a lap of at least 2½ inches.

The joints on the sand base should be not more than three-quarters of an inch wide, and on the concrete base not more than one inch wide.

In the work having a sand base of foundation, when the paving blocks are laid, a layer of clean, coarse sharp sand, free from dirt or pebbles should be spread over the surface in sufficient quantity to thoroughly fill the joints. This should be raked so as to remove pebbles and work the sand into joints thoroughly. The pavement should then be thoroughly rammed by one rammer to each two pavers to a firm, unyielding and uniform surface of the form prescribed for the finished roadway. But this first ramming should not approach nearer to the face of the work than twenty-five feet therefrom. This is necessary to prevent the possible influence of the ramming forcing the face of the work out of line and position.

When a section of pavement covering about 200 feet is completed as just described, it should again be covered with a layer of sand of the same quality and the rammers should again give it a thorough ramming, examining the surface carefully and using their pinch bars to bring into correct line and grade any of the blocks which may be out of place, leaving all courses true in line, all joints thoroughly filled and the surface perfectly uniform and unyielding. When this is done the paving should be covered with a layer of fine, clean sand to a depth of one-half inch. The traffic may then be allowed upon the pavement, but the sand should not be swept off until some two weeks after, so that the settlement of sand in joints may be made good and the joints be entirely full when they become thoroughly compacted.

The joints in the paving on a concrete foundation should be filled with gravel, which will pass through a sieve of five-eighths-inch mesh and will be retained by one of three-eighths-inch mesh. It must be free from dust and dirt. In order to insure this it would be best to have it screened on the work. Larger gravel is objectionable for the reason that the large pebbles are likely to wedge the blocks apart and throw them out of line, while the smaller ones fill up the voids and prevent the cement from flowing.

The gravel should be dried and heated in furnaces standing close to the face of the work, and it must be very hot when put into the joints. The work of filling the joints should be done expeditiously and should not precede the rammers more than ten feet. The ramming must be done rapidly and thoroughly, care being taken that all courses are straght in line and even in surface, conforming to the required crown or grade. No ramming must be done within twenty-five feet of the face of the work.

When the ramming has been completed ten feet in advance, the joints should be scraped or cleaned out, with an iron hook made for the purpose, and free from all gravel to a depth of two inches. The paving composition hereinafter described, heated to a temperature of 300 degrees Fahrenheit should then be poured into the joints until they are full to the top of the blocks. Hot gravel must then be added until the joints are full and compact and the gravel solidly imbedded to the surface. All work in connection with this jointing must be done with expedition, and sufficient appliances for heating, etc., should be at hand so that there will be no suspension of work until a section is completed. Joints must not be filled with hot gravel and left standing over night or through a rain storm, and if the gravel should get cold from this or any other cause the paving should be relaid.

No carting or driving over the pavement should be allowed until after the jointing is completed.

The paving composition or cement best adapted for joints in pavement over concrete foundation appears to be one of about twenty parts weight of refined asphalt, equal to Trinidad lake asphalt, and three parts of residuum oil mixed with one hun-

dred parts of coal tar, known as No. 4. This material should be examined and analyzed before use. It is well also to have the certificate of the manufacturer as to its composition. The materials for the joints must be heated and mixed on the work as they may be required.

A Portland cement grout is sometimes used for joints, but it does not appear to be as satisfactory as the bituminious composition for the reason that there is no elasticity. It is composed of one part Portland cement, heretofore described, and two parts of clean, sharp, screened sand mixed with water to such consistency as to readily flow into the joints. For this kind of work the pavement is rammed and the joints filled with sand. As for pavement on a sand base, the joints are thoroughly cleaned out with an iron hook or tool for that purpose, for one-half the depth of the blocks, and filled with gravel as provided for the bituminious composition; the grout is then poured and swept into them until they are completely filled. No traffic should be allowed on this work until at least one week after completion.

The foregoing is designed to describe as briefly as possible the standard granite block pavement in use in city streets, giving the materials involved, with the details and methods of construction generally practiced, as nearly as may be in their ordinary sequence.

CONSTRUCTION AND MAINTENANCE OF BRICK PAVEMENTS.

By E. A. Kemmler, Assistant City Engineer, Columbus, Ohio.

After a careful survey of the field of materials available for permanent street improvements, we are irresistably drawn to the artificial product made from the traditional clay, as the most promising paver, the one upon which our greatest hopes for the future are based.

It may therefore be of some interest to cite a few facts, by way of introduction, gleaned from fourteen years' experience with this class of paving material in my native city, Columbus, O.

We have to date 114 miles of paved streets, being about one mile for each 1,100 population. About 10 per cent. of the total yardage is of brick and artificial blocks, comprising in all twenty-six varieties.

All of the pavements, excepting about three-fourths of a mile laid since 1898, are upon an eight-inch foundation of broken limestone or gravel, and having, with few exceptions, tarred joints.

The first pavements were laid with West Virginia fire-clay bricks, made at New Cumberland, W. Va., the first paving brick manufactured in this country. These pavements were laid in 1887, the same year in which the Canton factory, the first in Ohio, was opened.

All of the pavements laid on residence streets (about 85,000 square yards) are still in good condition, and will last from eight to twelve years longer with proper maintenance.

The heavy traffic on the business streets has not dealt so kindly with them, however, and a considerable area has worn out, owing very largely to the total lack of repairs. From three to five years could have been added to the life of these pavements had repairs been commenced in time.

The bricks have generally worn flat, with a small percentage of chipped and rounded bricks, in spite of the inferior quality of the filler used.

During 1888 and 1889 a large area was paved with hard-burned red building bricks, principally on streets subject to light traffic. With the exception of a small area, laid on sand and tarred board foundation, these pavements have stood up surprisingly well, in spite of no repairs. About 60 per cent. are in good condition to last from five to eight years longer.

E. A. KEMMLER,
Assistant City Engineer, Columbus, O.

From 1888 to 1892 about 292,000 square yards of Hayden block pavement were laid. This is a half hollow block made from fire clay, 6 by 10 inches on top and 5 inches deep, having three rows of square beveled depressions 3-16 inch deep on the wearing surface, the hollow spaces underneath being filled with clay before being laid. About 30 per cent. have failed under heavy traffic; the balance will last from six to ten years longer. The greatest amount of wear has been at the edges. A hard filler would have added materially to the life of this class of block.

Since 1892 almost every variety of block made in Ohio has been used, with varying degrees of success, the fire-clay bricks giving the best results in the long run. This is no doubt due to the fact that the fire-clay bricks are less brittle than those made from shale and the use of the tar filler.

Cement as a filler has not been used since 1892. Its disuse was due to an unfortunate experience. In 1891 and 1892 Murphy grout

PAVING WITH BRICK.

was used on a number of brick streets, and the results were anything but gratifying. Within a short time the pavements failed in many places by bodily settlement in rectangular patches, and longitudinal cracks at the center, as much as a hundred feet in length. As the foundation was not of concrete, these settlements were no doubt due to local rearrangement of the foundation aggregate and absorption of the sand cushion. The characteristic rumbling, at first quite noticeable, disappeared almost completely after the final settlement, but the pavements had acquired an unsightly, pock-marked appearance, their beauty and symmetry was destroyed and the settled portion rapidly wore into chuck-holes after the cement had become loosened from the joints. The portions remaining intact are still smooth as a floor, and almost as good as new. Instead of improving the plans for this class of pavement by substituting concrete for the broken stone foundation, snap judgment was taken upon the cement filler, and its use abandoned. There are many, including the writer, who will dispute this conclusion.

As a result of our experience with brick pavements I am prepared to estimate the average life of brick on concrete foundation, and with proper maintenance, at from eighteen to twenty years, under the conditions of traffic which prevail at the capital city of Ohio at any rate.

An average of the estimates given me by twenty city engineers, from every part of the United States, reduces the life of brick to fourteen years, but our experience justifies a larger figure.

Having given this outline of our early lessons in brick paving, I shall attempt a brief discussion of present standard practice, which is calculated to give the best results for this class of pavements.

To begin with, a hard dry sub-grade is as essential as a good foundation. All soft or spongy places should be treated very thoroughly by removing the soft earth, if shallow, or rolling gravel or crushed stone into it, until it becomes firm and hard.

All house service pipes from sewers, gas and water mains, not already in place, should be laid to the curb lines. The back filling of all trenches should be done by or under direct supervision of the street contractor, who must guarantee the pavement over the same. Whether the back filling is to be done by ramming alone or partly by flushing will depend upon the kind of material. Stiff, sticky clay cannot be settled satisfactorily by either method. Such trenches should first be filled a few inches above the general surface, then thoroughly rolled and finally excavated from four to six inches, so that the thickness of concrete over them will be increased to ten or twelve inches.

It is essential that the surface of the subgrade conform as nearly as possible to the adopted crown of the street. It is therefore best to delay the final dressing until after the curb and subdrains have been laid. The necessity for subdrains will depend of course upon the nature of the subsoil. They should be laid close to the curb. Our present practice is to lay them just outside the curb,

BRICK PAVEMENT ON CHAMPION AVE., COLUMBUS, O., AFTER RAMMING AND ROLLING.

thirty inches below the top of the curb, with a covering of screened gravel. The trench for the curb is dug at the same time.

Curb is set upon six inches of gravel or broken stone, and backed with six inches of the same material. For the best results, however, concrete should be used instead of loose stone.

After setting the curb, the subgrade

should be finished and rolled with a steam roller weighing not less than 250 pounds per lineal inch. It is then ready to be thoroughly inspected and tested for inequalities of surface. All high places varying more than one-fourth inch from the true crown should be leveled off, the low places being left to be filled with concrete.

The next important step is the laying of the foundation. Six inches is generally accepted as the economical thickness of the concrete. As the work progresses small wooden stakes should be driven at intervals of five feet to serve as guides in spreading and ramming the concrete.

The platform should be of steel boiler plate. The sand should be silicious if possible, containing not more than 3 per cent. of clay; it should be dry when used. The sand and cement must be thoroughly mixed by hoes until the colors have completely merged. The proper percentage of water

TESTING CROWN OF CONCRETE FOUNDATION.

will vary with the temperature and the humidity of the atmosphere. Enough water should be used to prevent the concrete from drying too fast, but in no case ought the mixture to be so wet that the mortar will run off the board and the cement settle into place without vigorous ramming.

My own experience has been that, under the most favorable conditions of the atmosphere, the dryest mixture yields the best results, but I have also learned that it is unwise to make the concrete so dry that the mixing of the mortar tires the men. Lack of uniformity in the product is certain to follow such a course. If the concrete were mixed with machines the amount of water could be regulated at pleasure without sacrificing uniformity, but not with unskilled hand labor.

Too much care cannot be given to reducing the variations of the concrete surface from the true crown to a minimum. For unless the sand cushion forming the paving bed be of uniform thickness no amount of ramming or rolling will settle the brick so that they will possess equal power of resistance to vertical pressure.

In order to prevent the concrete from drying too fast on the surface, it should be covered as soon as practicable with a blanket of paving sand, which should be kept moist by sprinkling as often as necessary.

There has been some discussion as to the best thickness of the paving bed, the opinion of the engineers varying from one-half inch to two inches. Taking as a model Detroit, with its magnificent streets paved with brick transported from the Buckeye state, we would use a bed one inch thick. I have found an inch to give excellent results. One point gained by a thin cushion is the extra care used by the contractor in shaping the surface of the foundation.

The sand for the bed should be soft and velvety, rather than sharp and soft, for the former on account of the cementing property of the clay remains hard and stable after ramming, while clean sand cannot be rammed into equilibrium. A calcarous sand containing 12 per cent. of clay has given the best result in our city.

Practice varies in the manner of settling the brick upon the bed, some engineers specifying ramming, others rolling. I have found that ramming alone, while more effective than rolling, does not produce as even a surface as rolling, while rolling alone has a tendency to tilt the brick. We therefore require both ramming and rolling in the order mentioned; the results have been highly satisfactory. Defective and broken brick are picked out and replaced after the pavement has been rammed, but the pavement is again inspected after rolling to detect any bricks which may have been broken during that operation.

We now come to a critical point in the construction of our pavement, the filling of the joints. So far no filler has been invented which will meet all objections, and as the opinions of engineers are so radically different, it is impossible to prescribe any class of filler which can be pronounced as the best under all circumstances.

So much is certain: Sand has the advantage of cheapness, but offers no protection to the brick against chipping.

Tar pitch, which is expensive, gives excellent service as long as it remains in the joints, but summer temperature and the law of gravitation cause it to flow and collect in the gutters, where it remains a thick, unsightly scale.

Cement grout, while much cheaper than tar or asphalt, produces far better results upon a well-constructed street, but in such cases as the experiences of Columbus it will certainly do more harm than good.

From one of the best papers prepared for the last meeting of the National Brickmakers' association by George R. Grimes of Terre Haute, Ind., I quote this sentence:

"In my judgment the cement filler is the best, and none other should be used." The discussion which followed brought out the following from one of the members: "The brick streets of this city (Terre Haute) show for themselves that Mr. Grimes is thoroughly competent to discuss this subject. They have brick streets there that have been down under fairly heavy traffic for six or eight years, and they are just as smooth as this marble floor. The splendid condition of those pavements is due to the great care exercised in the little details of the work—the laying of the brick, preparing the filler and rolling the brick." In direct contradiction to Mr. Grimes I quote a statement of your president, made at the Toronto meeting last year: "My conclusion is that Portland cement is not a proper material to use for such a purpose." My own view of the matter is that a filler having such excellent quality as the cement grout should not be discarded without a fairer trial than it has had thus far. If the rumbling noise is due to expansion of the brick, occasional joints of tar or asphalt ought to remove this defect. If the failures are due to settlement of the foundation or sand cushion, the substitution of Portland for natural cement, and a thinner and more carefully prepared sand cushion ought to remedy this trouble.

I have often thought that it would be a good plan to fill the joints with sand at first, and apply the grout a year later, after first cleaning out the joints with a jet of water or air blast. Surely no appreciable settlement can occur after that. I am satisfied that our original pavement, laid twelve or fourteen years ago, especially the Hayden block, could have their life increased from three to five years by such a course applied even now.

The presence of street railway tracks on a street greatly complicate the problem of paving, especially where there is any doubt as to the authority of the engineer over that part of the roadway.

Wooden cross-ties are objectionable for reasons unneccessary to mention. Two years ago an experimental piece of track was laid by the Columbus railway company, upon longitudinal stringers of Portland cement concrete, made in sections of about twelve feet in length. The rails were laid directly upon the concrete without cross-ties, and held in place by bolts imbedded in the concrete.

This work has stood up very satisfactorily, and the pavement has remained even, while the track alongside, laid upon wooden cross-ties, is already exhibiting evidence of internal disturbances of the paving material.

We now specify longitudinal stringers six to eight inches deep under the rails, with cross-ties of angle bars spaced six feet apart, and a nine-inch full-grooved rail, for all new work.

All bricks used on our streets during the past three years have been tested in accordance with the National Brick Manufacturers' association standard. The tests thus far have not given results which would inspire one with confidence in the method of testing. Bricks known from experience to be of poor quality, bricks that would be rejected by any experienced paver, were in many cases shown by the tests to be equal to the best, those that were known to be the best; but when these bricks were laid upon the street, when the real test was commenced, they were found sadly wanting. It is therefore very gratifying to note a recent test of seven varieties of paving brick at Columbus by association rattler test, using foundry shot

BRYDEN ROAD, COLUMBUS, O.—A FINE ASPHALT PAVEMENT ON OLD BOULDER ROADWAY.

the new National Brick Manufacturers' in addition to the bricks. This test placed every variety of blocks in that class or grade of quality, where experience with its use on our streets would require it to be placed; hence our confidence in the rattler test has gone up several points this year.

Before the art of modern street paving will attain its highest perfection, the "political" inspector must be abolished. The high class of workmanship required, and the many important little details connected with the work demand intelligent and competent supervision. The "political" inspector can do no good; he can do harm by causing unnecessary disputes and delays. He is a mill weight on the shoulders of a good contractor and a source of continual annoyance to the engineer. It is far better to dispense with an inspector altogether; but if we must be afflicted by his services, I would advise instructing him to "saw wood" at all doubtful stages of the work and call the engineer.

But if those in authority really desire to have a man of experience and ability for the one representative of the people who pay for the work and the inspection, and

who is on the work all the time, they ought to select the best in the field and pay him a decent salary.

Much has been written upon the subject of highway construction, and much more could be said of this subject upon this occasion had we the time; but I expect to read more about the proper maintenance of paved streets during the next century than their construction. We denizens of the nineteenth century, with our short experience, have learned fairly well how to build good streets, and we have built them as rapidly as we knew how, and in accordance with the good old American custom, without any thought as to the future. From such figures as can be obtained, the total original cost of street improvement in the United tates has not been far from $500,000,000. Columbus alone has paid in round numbers $5,000,000 for paved streets, equal to one-eighth of the total decennial appraisement of its real estate. Unfortunately, American cities have not yet commenced to learn the art of maintaining their street pavements. The necessity of preserving from rapid deterioration and ruin this enormous wealth showered upon the municipalities by their public-spirited and progressive citizens, has not yet dawned upon our cities, with a few notable exceptions like Philadelphia, Buffalo and Detroit.

The 1,050 miles of improved and 430 miles of unimproved street in Philadelphia are the pride of its citizens and the authorities claim for that city the first rank as a paved city. During the year 1899 $510,000 were expended for repairs alone, besides $1,334,514 for removing cobble stone and rubble pavement and repaving with asphalt. The entire work was done by contract and paid for out of the city fund. I may remark, by way of parenthesis, that we have saved a considerable percentage of the cost of replacing the cobble stone pavement with asphalt by using the old pavement as a foundation. It may sound strange, but our best asphalt streets today were laid upon old bowlder and stone block foundations. Buffalo and Detroit likewise have liberal funds at their disposal for the maintenance of streets, and the results are apparent upon an inspection of their pavements.

We at Columbus know absolutely nothing about street maintenance; Cleveland, the largest city in Ohio, knows just as much as we do upon this subject—$17,542 was the total amount expended for repairs in that city last year, which caused the following observation from the superintendent of streets in his last annual report:

"When it is taken into consideration that there has been added over nineteen miles of new pavements, hundreds of catchbasins, and that many additions in miles of pavement and numbers of catchbasins will be made during the ensuing year, it is plainly evident that the present appropriations are totally inadequate, a fact which compels us to forego taking up and carrying to completion many necessary repairs."

Cincinnati is not far ahead of us, except as to the asphalt streets. And this in the state where brick paving originated, and where the paving brick factories are, as it were, within a stone's throw of each other, where the bricks laid in the streets which are the pride of Detroit are made.

If this is the status of the science of street maintenance in Ohio, what is to be expected in states less favorably located, as to the cost and quality of the paving materials?

I believe that it can be shown from actual experience that it costs no more to maintain a brick pavement than to let it wear out without repair and repave the entire surface. The diminished wear and tear of vehicles, immunity from damage suits and the decided advantage of continued good appearance, are some of the immediate points gained by the former course.

Take, for example, one of our worn out brick streets, twelve years old. It is safe to assume that this street could have been maintained without repaving for at least sixteen years at a cost not exceeding $0.50 per square yard. The annual cost is as follows, assuming cost per square yard at $1.50 on interest at 4 per cent:

—Without Repairs—Life Twelve Years—	
Interest	$0.060
Sinking fund	.100
Total	$0.160
—With Repairs—Life Sixteen Years—	
Interest	$0.0600
Repairs	.0310
Sinking fund	.0687
Total	$0.1597

As a purely business proposition these figures indicate that it is worth $0.50 per square yard, paid in sixteen annual installments, to prolong the life of this particular street 33 per cent.

But the dollar and cent way of contemplating this problem is certainly not the most enlightened one at this stage of civilization. After the streets have been paved they must be maintained for the sake of appearances and safety to travel, aside from all financial considerations. If the money for maintenance is not in sight the street should not be built.

As to the manner of apportioning the cost of maintenance, the Philadelphia plan of maintaining all the streets, both improved and unimproved, out of the general revenues of the city seems best adapted for the larger cities with very few unimproved streets. For the smaller cities, with a large

percentage of unimproved streets, a modification of the Buffalo plan of paying the cost of repairing out of the general fund, and assessing the cost of repaving upon the abutting property, would seem to be the most equitable one.

The Buffalo charter requires the asphalt streets to be repaired by the city, unless more than one-third of the roadway is in need of repairs, which is the weak point of this plan. The stage at which asphalt streets can be economically repaired has passed when the percentage of annual repairs necessary exceeds 10 per cent. of the total roadway.

One of the greatest enemies of paved streets is the poorly back-filled trench, for whatever purpose opened after the pavement is laid. There is but one effective way of preventing settlement over the trenches, and that is by requiring a permit to be issued for every such opening, for which the contractor must pay liberally besides making a deposit sufficient to cover the cost of refilling and repaving over the opening, this work to be done by the city. The permit fees can be used to swell the repair fund.

Last year several miles of our paved streets were torn up by the natural gas and telephone companies. The work of refilling and repaving was done under the authority and supervision of the city engineer, who required the use of four to six tampers to one shoveler in backfilling. The work was well done. In but two cases has there been any settlement over these trenches and the pavements have not suffered a particle on account of these openings.

Columbus has twice secured legislation for creating a repair fund by the licensing of vehicles of all classes, but just as often the laws were tested and declared unconstitutional. There is quite a number of cities, however, where such license laws and ordinances are effective, and the revenues from this source form an appreciable addition to the repair fund.

The annual cost for repairs alone is but one-fifth of the total cost of a street, as shown by the figures in the example presented above, and the property-owner is certainly making a modest demand upon the city when he asks it to pay the cost of keeping his street in good repair during its natural life.

It is not difficult to picture the state of a man's mind who is paying street assessments year after year, at the same time seeing the roadway in front of his house wear full of chuck holes and finally go to pieces long before the last assessment has been paid. It certainly looks like confiscation, or in plainer words, highway robbery, to a disinterested person. But "all things come to him who waits," and the twentieth century will no doubt dispose of this question successfully, as it will of the many problems connected with municipal government in this country.

This association is to be congratulated upon the great work which it has already accomplished in this direction, and the recognition and prestige which it has gained during its short career, and it can be confidently expected that its scope and usefulness will grow apace as it grows older and stronger, gathering momentum and energy with each day of its existence, so that its influence will come to be felt in every progressive community in the United States.

REPORT OF THE COMMITTEE ON SEWERAGE AND SANITATION.

By W. K. Eldridge, C. E., Chairman.

Although no report from this committee has been made since the Nashville convention, the report presented at that time was such an extended and able one, on the subject of sewage disposal, that this report will constiute a continuation of the same to date, following modestly in its footsteps. * * *

Public attention has been so attracted to the question of sewage disposal that courts and legislatures, not to mention the congress of the United States, are taking it up in a more or less crude and uninformed manner, by which much danger exists of the perpetration of great injustice upon our municipalities. One bill was introduced in the congress of so drastic a nature that no farmer located along the bank of a running stream would dare manure his crops without connecting his underdrainage with a sewage disposal system. The courts are beginning to make decisions and serve injunctions without any regard to the ability of a community to carry out the extreme mandate of the court; and some legislatures in states having no constitutional or other prescribed limitation on bonded indebtedness and rates of taxation are beginning to consider and pass statutes to comply with which is simply impossible, unless these restrictions on raising money are removed. It behooves all municipal officers to keep a close watch on these tendencies, not that proper efforts toward the improvement of existing conditions should be thwarted, but that by a campaign of united influence and education they may be guided into the proper channel and applied with discrimination. For instance, it is easy to see that a small city on a large watercourse may safely dispose of its sewage by dilution, while the large city on a small watercourse will get into serious trouble by adopting the same means. Yet a statute

prescribing equivalent methods for each would be manifestly unfair.

The tendencies of the courts in the various states have as to details been almost as various as the states, ranging from extreme severity to extreme leniency, but the quotations given below, taken from a recent decision, seem to be based on sound principles of equity, and doubtless in the end will prevail universally, if justice and equity are to prevail.

The judge of the U. S. Circuit Court for the western district of Arkansas, (Carmichael vs. City of Texarkana, 94 Fed. Rep., 561), lays down a number of propositions which he considers established by an almost unbroken line of authorities. These are briefly as follows:

It is immaterial as affecting the liability

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Chairman of Committee on Sewerage and Sanitation.

of the city, whether the contents of a sewer are discharged directly on the property of an individual or at such point that the sewage and other refuse taken along with it must necessarily be carried there by a conduit or gravitation.

If a municipal corporation, by its system of constructing the sewers, renders an outlet necessary, it must provide one. It cannot discharge its sewage on private property, and, if it does so, it is prima facie liable. Where the city has emptied one of its sewers on private land, it is a direct violation of the owner's rights, a continual trespass on his property, and the city is liable just as any private person would be.

A municipal corporation has no right to collect the sewage of a large portion of a city, and, by artificial channels, cast it upon the lands of another; and for such acts it is liable in damages, whether or not they be done in conformity to a plan adopted by its officers, judicial or otherwise.

A city is liable if it undertakes to collect water in one channel and wrongfully pours it upon another's land. This principle has been uniformly applied to the acts of such corporations in constructing sewers, drains and gutters, whereby the surface water of a large territory which did not naturally flow in that direction was gathered into a body and precipitated upon the premises of an individual, occasioning damage to him. A court of equity has jurisdiction not only to determine the question whether a nuisance exists, but to make a decree that it be abated.

The right of an individual citizen to abate a public nuisance arises only when it becomes an obstruction to the exercise of his private rights, or when he receives some special or peculiar injury from it distinct from what he suffers in common with the public.

In the case of Washburn & Moen Mfg. Co. vs. City of Worcester, (116 Mass. 460), the court ruled:

"Where a city or a board of municipal officers is authorized by the legislature to lay out and construct a system of sewers and drains, and provision is made by statute for the assessment, under special proceedings, of damages to parties whose estates are thereby injured, the city is not liable to an action at law or bill in equity for the injuries which are the necessary result of the exercise of the powers conferred by the legislature. But if, by an excess of the powers granted, or negligence in the mode of carrying out the system legally adopted, or in omitting to take due precaution to guard against the consequences of its operation, a nuisance is created, the city may be liable to indictment in behalf of the public or to suit by individuals suffering special damage."

Also, Chapman vs. City of Rochester, (18 N. E. Rep. 88):

"* * the case comes within the general rule which gives to a person injured by the pollution of air or water, to the use of which in its natural condition he is entitled, an action against the party, whether it be a natural person or a corporation who causes that pollution."

In the celebrated case of Platt Bros. & Co. vs. City of Waterbury (Conn.), the company obtained an injunction against the city sewage being discharged into the Naugatuck river after April, 1902. The opinion of the supreme court on appeal draws the line between governmental acts which may or may not be done with immunity to the executant thereof. A governmental act is any act which the state may lawfully perform or authorize, but immunity from their results is given to those who carry out but a certain portion of them. A governmental act carrying immunity to him who executes it is done in strict pursuance of some absolute duty of government imposed by the state on a person or corporation, who receives no profit or advantages peculiar to himself from its execution. Hence a mere

grant to a city of authority to construct, for the convenience and benefit of its inhabitants, sewers to carry off their refuse matters to some neighboring stream, does not necessarily make such use of their sewers a governmental use in the sense indicated.

"The right to pour into the river surface drainage does not include the right to mix with that drainage noxious substances in such quantities that the river cannot dilute them or safely carry them off without injury to the property of others. The latter act is in effect an appropriation of the bed of the river as an open sewer, and the proposition that it may become lawful by reason of necessity is inconsistent with undoubted axioms of jurisprudence. * * * It may be necessary for a city to thus mix with its drainage such substances, but it is not necessary to pour such mixture into the river without purification; indeed the purification is coming to be recognized as a necessity."

In England the legislative authority for emptying the sewage of cities into water courses and rivers is coupled with the provision that no nuisance is thereby authorized.

It will be well for municipal officers to watch closely the trend and tendency of courts; for even in those milder cases where no damages are enforced, it is possible for complainants to obtain injunctions against the continuance of the act complained of. The supreme court of California has in one case gone so far as to enjoin against the effluent from a sewage farm entering a creek. On the other hand, the supreme courts of New Jersey and Indiana have ruled with extreme liberality dent tendency is in the other direction.

In continuation of the former committee report first alluded to herein, it may now be said that great strides have been made in the direction of bacterial purification in a practical way, which is not surprising when it is considered that this process is in the line of assisting nature, instead of interfering with her methods as is done by chemical and electrical processes.

All sewage disposal systems may now be broadly classified under two heads, the chemical-mechanical and the bacterial; for not only the septic tank and contact filter methods, but also the intermittent filtration and irrigation methods, together with all their combinations, depend on bacterial action for what measure of success they have attained. It is true that much of the purification afforded by the bacterial processes is chemical in its nature, but seems to be a natural chemical process instigated and kept up by the bacteria, as it does not occur without their presence. And where the effluent from a chemical process is further purified by filtration or irrigation—and this is almost invariably found necessary—bacterial action is after all the main dependence for success. One defect of this process is, therefore, that the destruction of bacteria in the precipitation tanks is so great that much time must be granted the filter beds in which to restore them to practical activity. Another drawback is the accumulation of precipitated matter, called "sludge," to an extent that much trouble and expense must be incurred in the disposal of this material, in some cases requiring subsequent chemical or other treatment to render it innocuous. In opposition to preconceived opinions, the manurial value of this sludge has been found to be practically nothing, at least in the United States, and its extreme alkalinity renders it actually unsuitable for dressing lands of certain kinds. The supposed loss of the elements of fertility may, however, be neglected; any revenue from the works may be considered incidental, as the prime consideration is the breaking up into harmless elements of these waste products of civilization. When discharged into small streams, the chemicals often cause precipitation in the stream itself, with offensive decomposition. Also, effluents direct from precipitation tanks have been known to set up secondary putrefaction with disastrous results. Variations in quality of sewage call for variations in the proportions of chemicals, so that difficulties are often due to injudicious or extravagant use of chemicals and the carelessness or neglect of attendants.

The main feature of the septic apparatus for reducing suspended organic matter in sewage before it is filtered, is an airtight tank; though it has been discovered experimentally that open tanks, after being used long enough to establish a thick coating over the fluid contents, become practically airtight for this purpose. The sewage passes directly into the tank from the sewer, and is allowed to pass through slowly enough for the bacteria of decomposition and afterwards of putrefaction to break up the organic matter into simpler forms. An equal efficiency seems to be afforded by the contact filter system of so-called "bacteria beds," which are sometimes used alone and again to receive the effluent from septic tanks. Both these systems seem to be a bacterial treatment of sewage in preparation for its final purification by filtration, as distinguished from a chemical treatment for the same purpose; the advantage of the bacterial treatment consisting in the absence of the expense of furnishing chemicals and removing sludge, and the results usually superior.

The theory that organic life alone cannot produce nitrification is disproved by these bacterial systems. In ordinary filtration schemes five feet in depth of fine sand will handle about 100,000 gallons of clarified sewage per acre per day. The interposition of

the bacterial treatment seems to permit of a great reduction in filtration area.

The Lawrence (Mass.) experiments demonstrate that practically all of the organic matters of sewage may be removed by bacterial action in artificial filters. These experiments also seemed to prove that deep filters are safer than shallow, low rates of speed safer than high, and at the same average rates continuous filtration as effective as intermittent, with the added advantage of keeping filter beds open in winter. Filtration beds will work in winter, even if first allowed to freeze and then covered with sewage. The effluent, however, will be less perfect than in summer. But the amount of sewage which can be applied in a single dose does not indicate the amount which can be purified in a given time. As water capacity increases, the air spaces are correspondingly decreased, the reduction of air spaces occurring where the organic matter is greatest. But the results are much superior to any chemical process, which clarifies and to a certain extent deodorizes sewage, but true purification is doubtful from the bacterial standpoint.

Any method of land treatment gives an effluent of much greater purity than any chemical or mechanical process and costs ordinarily less. All chemical processes should be followed by filtration; and after filtration by any scheme, a further purification by broad irrigation might obviate all objection.

Patented schemes for purification by electrolytic and other anti-septic processes will be only mentioned in this report, as they all fly in the face of nature by attempting utterly to destroy all bacteria, the beneficient as well as the pernicious, and are of doubtful efficiency.

We are now up to the question of what constitutes a satisfactory effluent? On this subject opinions are almost as various as the persons expressing them. It may be safe to maintain, however, that the quality of an effluent may vary according to its destination, and the uses made, if any, of such destination. The capacity of an effluent's destination for natural purification after great dilution may in many cases be counted on, and less efficiency required of the purifying plant. No fixed standard can apparently be applied to all localities, and if legislatures in enacting and courts in construing laws on this subject will take cognizance of the fair application of this great basic principle, there is little likelihood of injustice being done to any municipality. The bare fact that one system shows inferior results to another should not condemn it when not correlated with all other modifying facts and conditions.

One branch of the subject beginning to receive more attention is the pathogenicity of the final effluent. It has been established that the straining out of disease-producing bacteria does not get rid of their poisonous products, which are soluble in water. But these products do not multiply in water, and may be so diluted as to become harmless. At the same time it becomes evident that no scheme of sewage purification can be so complete as to obviate the necessity for the purification of water supplies drawn from surface sources, which may be even further polluted by the passage of the water over and through decaying vegetation, the myriad carcasses of dead animals, insects, etc., the fertilizers used in farming communities and other sources of pollution.

And after all is said and done, one of the subjects of highest importance to be inculcated in our institutions of learning, from the college down to the township school, is a knowledge of the principles of hygiene and their personal application by each individual to himself; for every living person is continually taking into his physical system a myriad of pathogenic germs in the food he eats and the air he breathes, as well as the water he drinks, which pass harmlessly through or are destroyed in his internal economy unless favorable conditions exist there for their culture with destructive effect. Such conduct of life, therefore, by each one of us, should be pursued that the highest physical development would be maintained, and the knowledge of how to gain and keep such development should be assiduously cultivated. The child is entitled to be well born and well bred; and while all schemes for bettering the quality or avoiding the pollution of water supplies are laudable and cannot too soon be undertaken where needed, they do not constitute the sole panacea for all our ills.

SEWAGE PURIFICATION.

By E. A. Hermann, Sewer Commissioner of St. Louis.

In all countries streams are used as open sewers until increasing population produces pollution to a point of intolerable foulness. Sewage purification must then be resorted to.

Inland towns and cities (especially those situated on small streams) suffer sooner than towns and cities located on the seacoast or on the banks of the larger rivers. Many of our smaller cities are now obliged to purify their sewage; some of the larger cities will soon find it necessary to follow their example, especially those located on streams or lakes used as sources of water supply by themselves or by other cities. In due course of time every inland town and

city and most of those situated on the bays of our seacoast will be obliged to purify their sewage. This is a work of generations which will be accomplished in each particular locality only when necessity compels action.

Posterity will do most of the work. We can, however, greatly assist those who come after us by keeping in view the ultimate necessity of sewage purification and shaping our course accordingly. All future sewer construction work should be designed so that the work done now can be adapted with few or no changes to the future purification plant when its construction becomes a necessity; so far at least as we are now able to foresee, in the light of present knowledge and experience, what the requirements of such a plant may be.

E. A. HERMANN,
Sewer Commissioner, St. Louis.

The outflow of the ordinary sewer is not a thick mass of filthy slime, as many imagine; it is mostly water. One thousand parts of the average sewage contain 998 parts of water, one part of organic and one part of mineral matter. The organic matter only is subject to putrefactive decay, and its removal without danger of offense to the community is the object sought by all sewage purification systems. These systems may be roughly classed under two heads:

I. Sterilization, sedimentation and chemical precipitation.

II. Bacteriological decomposition.

Of these systems only those under the later heading fulfill the requirements of sanitary sewage disposal; the rapid resolution of organic matter into harmless elements or new combinations of elements forming harmless compounds.

The systems under the first heading provide only for a partial sewage purification, mainly for its immediate removal from sight and smell, postponing its decomposition to a later day and to another place.

Taking up the systems of sewage purification noted under the first heading, there are:—

1. Sterilization, which is merely a method of disinfection by antiseptic chemicals applied to flowing sewage before it is discharged into a natural water course. The offensive odor of decaying organic matter, as well as some of this matter itself, and most or all of the microbe life-producing putrefactive decay are thereby destroyed, but as soon as the sterilized sewage is discharged into the water course the antiseptic is diluted or evaporated and loses its power of sterilization; the remaining organic matter soon becomes inoculated with new germs of decomposition and the work of putrefactive decay begins.

2. Sedimentation provides for the settling of the heavier particles in sewage in large tanks or basins, the skimming off (and removal) of the lighter particles which float on the surface and the discharge of the partially clarified (but not purified) water into some natural water course. This clarified water contains large quantities of organic matter in solution, a most favorable condition for the beginning of putrefactive decay. This process is a good beginning toward sewage purification, but is utterly worthless as a purification system if stopped at this stage.

Sterilization and sedimentation are used only for small towns and large private residences, schools, convents, etc. They are incomplete and unsatisfactory methods of sanitary sewage disposal and plants of this kind should be abandoned for better methods.

3. Chemical precipitation is a process of sedimentation combined with coagulation; it is produced by the application of chemicals (copperas and milk of lime are most generally used) to the flowing sewage as it is discharged into large settling tanks or basins. The precipitate (called sludge) is a heavy mass of slime, while the water above it is comparatively clear and much less polluted than before application of the chemicals. After standing some hours the water is strained off, or, in some large tanks, it passes off continuously over a weir; the latter class of tanks are made long enough to permit complete precipitation, while the sewage flows through them at a very slow rate. The effluent water is discharged into a stream, and at some plants it is first further purified by intermittent filtration, a method of sewage purification which will be described in detail further on. The tanks are cleaned at intervals; the sludge is pumped out and buried, hauled to farms to be used as a fertilizer, dumped at sea, or compressed

into cakes by hydraulic presses and then buried or ground up for use as a fertilizer.

The expense of hauling sludge to farms or preparing it for use as a fertilizer is more than it is worth for that purpose. It is much cheaper to waste it by burial in long rows of ditches or dumping at sea, than to attempt to utilize it for farming purposes.

Chemical precipitation has long been in use in London, Birmingham, Glasgow and other large cities in England and Scotland; also in Worcester, Mass., and a few smaller cities in the Eastern states.

London operates a fleet of six large steamers to carry sludge from its precipitation tanks to the sea, where it is dumped in deep water.

The large expense for chemicals, labor for operating precipitation tanks, transportation of the sludge, etc., combine to make this system of partial sewage purification a very costly one. It was believed, at one time, that the sludge for agricultural purposes would partly or wholly balance this expense, but this view is not confirmed by experience. The system has not proven a satisfactory one, and it is not likely that any new plants of this kind will be erected.

The systems of sewage purification which modern sanitary science points out as embodying the correct principles are those which guide and direct the decay of organic matter by means of bacteriological decomposition. The organic matter in sewage is of both animal and vegetable origin; it consists mostly of grease, oil, excrement, urine, paper, soap, and fragments of meats and vegetables. These are the putrescible constituents of sewage whose decomposition becomes dangerous to life and health.

All organic matter, both animal and vegetable, is subject to putrefactive decay; this decay may be prevented for a time by artificial means, but the moment the effect of such means ceases decomposition begins; it is a necessary process of nature which can not be permanently arrested. The substances which have served the purposes of animal and vegetable organisms begin to decay as soon as life is extinct; they are resolved into elements or combinations of elements into new forms, which may be consumed as food by plants and animals, and thus again become useful in the economy of nature. The nature of this decomposition is not yet clearly understood; it is known, however, that it is brought about by micro-organisms, generally called bacteria, of many different kinds requiring different conditions for their life and development, different foods, and yielding different products by their work. The manner in which these minute scavengers operate is not yet known; it is believed, however, that they break up the complex organic wastes in sewage by removing one or more atoms of a compound, thereby withdrawing the support on which the structure of the compound depends, just as a card house depends on the support of one or more of the lower cards and is broken up if such cards are withdrawn. The result is the decomposition of the putrescible organic matter into the gaseous and mineral constituents, thus changing it into forms which are not harmful to the public health or obnoxious to sight or smell.

The bacteria which cause decomposition of organic wastes may be divided into two principal classes, aerobic and anaerobic; the former depending on an ample supply of air for their life and development, and the latter flourishing only in the absence of air. The former are the bacteria of oxidation (burning), the latter are the bacteria of putrefaction. Aerobic bacteria develops most advantageously in organic matter when it is finely divided (as in solution in water) and spread over and around porous soils or sands, where each grain of soil or sand is enveloped by a thin layer of the waste water, and this in turn surrounded by air. Under such conditions aerobic bacteria develop in enormous numbers in an incredibly short space of time, and quickly oxidize the noxious organic matter. An ample supply of air must be provided for these bacteria; the sewage water can not, therefore, be in continual contact with the grains of soil or sand; it must be brought on at intervals, alternating with supplies of air drawn over the surface or through the layer of soil or sand. Anaerobic bacteria develop in the absence of air; their work is done within the body of the sewage water, and consists in breaking up the organic wastes in such manner that they are liquified or taken up in solution by the water, and thus prepared for oxidation by aerobic bacteria at a later stage of the process of decomposition.

Which one of these processes of decomposition (or in what order) shall take place without creating a nuisance or injuring the life and health of the community can be readily determined by suitable devices and by proper regulation and supervision. This is the object of all methods of sewage purification by bacteriological decomposition, which attempt to guide the forces of nature by artificial devices to perform the work desired by man; and these methods may be divided into the following classes:

1. Broad irrigation (sewage farms).
2. Intermittent filtration.
3. The septic tank.

1. Broad irrigation is the oldest and simplest method of sewage purification. It aims to utilize the sewage as a fertilizer by allowing it to run over fields planted in grasses, grains or vegetables where it serves as food and drink to the growing crops. Sandy soils are best adapted to this method of sewage disposal. Part of the

water in the sewage is absorbed by the vegetation and the balance filters through the soil and is carried away purified in the ground water, or it is discharged into a natural water course by means of open-jointed sub-soil drain pipes laid for this purpose. The organic matter in the sewage is decomposed and converted into plant food; thus a rearrangement of elements is brought about, forming new combinations beneficial to the uses of man.

It is essential, of course, that the crops receive no more sewage than is necessary for their proper nourishment; drowning the crops by an excess of sewage must be avoided. The fields must therefore be separated from each other by low dykes, and the sewage turned on intermittently to the various fields, at intervals of days and weeks, as the requirements of their crops may necessitate; they must not receive any sewage during harvest time and very little when it rains; at such times the sewage must be wasted on arid fields. This requires a very large area of land for the disposal of the sewage, at least one acre for each 250 inhabitants; the system is therefore best adapted to small towns and isolated public institutions such as prisons, hospitals, asylums, etc., where the necessary land can be obtained at moderate prices and within short distances of the towns or institutions. The system is impracticable for nearly all large cities, mainly on account of the enormous quantity of land required and its great cost. Many isolated institutions, towns and small cities in England, France, Germany, and in our Eastern states are using this system; a part of the sewage of Paris, France, is also treated by broad irrigation. The only large city using this method for disposing of all of its sewage is Berlin, Germany; the sandy soil in its vicinity is peculiarly adapted to this purpose., The city owns 28,000 acres of land and at present uses one-half of it (an area nearly five miles square and almost equal to the area of Berlin) for the purpose of a sewage farm. This farm cost $10,000,000, the annual operating expenses are $550,000, and the receipts from farm products are $600,000, leaving an apparent profit of $50,000; but the interest on the capital invested is not included in the expenses; when this is done a large deficit appears.

It had been fondly hoped, at one time, that sewage farming (which returns to the soil what has been taken from it) would yield a money profit; these hopes have not been realized. No sewage farm has proven to be a profitable income-bearing investment, but its value to the community can not be based strictly on direct money profits; indirect benefits to the public may be worth more than actual money profits.

2. Intermittent filtration is the second step in the development of the problem of sewage purification. Experience had shown that sewage can be purified by allowing it to filter through natural soils, and that it can be utilized as a fertilizer in this process; but the value of the fertilizer is so small in comparison to the great cost of its utilization (mostly due to the great cost of the large areas of land needed) that it is not true economy to attempt to save it. A very much smaller area of land will purify the same quantity of sewage if artificial filter beds of sand or cinders are prepared and the sewage allowed to filter through them at regular intervals, varying with the strength of the sewage, in periods of twelve to twenty-fours hours. The filter beds are composed of coarse sand, coke, charcoal, cinders or similar material from four to six feet thick, underlaid by rows of open jointed drain tiles connecting with a large central effluent pipe leading to a natural water course. The filter beds are from one to three acres in area, and separated from each other by earth embankments or masonry walls.

The operation of the process is as follows: Sewage is allowed to flow over a filter bed until it is about one inch deep on the surface of the filtering material; the sewage is then shut off and turned onto the second bed, and when this is full, to the next bed, etc. The sewage slowly sinks through the porous material of the filter bed and the water it contained is discharged through the effluent pipe into some natural water course. After draining and resting for a short time (generally from twelve to eighteen hours), sewage is again turned on the beds and the operation is repeated. This can be done indefinitely without clogging the filter bed or imparting an offensive odor to the porous material of which it is made up. Intermittent filters have been operated continuously for ten years without the slightest indication of clogging or foulness of the filtering material. In the course of its passage through the filter beds from 90 to 99 per cent. of the organic matter (and also of the bacterial life) disappears; what becomes of all the organic filth which has been poured onto the filter beds is not plain.

It is believed, however, that it has been decomposed and oxidized, as previously explained in describing the work done by the aerobic bacteria. These bacteria can thrive only when there is a plentiful supply of air, and it follows, therefore, that sewage can be poured onto these filter beds only at intervals, with periods of rest in between allowing thorough aeration of the full thickness of the filter bed of sand or other porous material. For this intermittent action in the supply of sewage to filter beds the name "intermittent filtration" has been derived. It has been observed that one acre of such filter will purify 50,000 gallons of sewage in winter and 100,000 gallons in summer.

The total area of filter beds required for a large city is therefore greater than can practicably be obtained by many cities. Efforts to reduce this area required to purify sewage led to experiments which resulted in the third method of sewage purification by bacteriological decomposition.

3. The septic tank is merely an artificial rotting chamber; an elongated tank or basin (either open or covered, though generally covered) through which the sewage is allowed to flow at a very slow rate of

speed, the effluent water passing over a weir and then through intermittent filter beds. While the sewage is thus slowly passing through the tank the heavier particles of organic or mineral matter sink to the bottom; the former (being under water where air is excluded) is immediately attacked by anaerobic bacteria, which rapidly multiply to countless millions and quickly break up the organic matter into its gaseous and mineral constituents. The latter sink to the bottom of the tank, the former rise to the surface of the water and pass off into the atmosphere. The amount of the deposit of mineral matter is not nearly so large as the deposit of sludge formed by chemical precipitation and is more easily disposed of by pumping or carting. Two or more septic tanks are built for every purification plant, one tank then to be cleaned while the other or others are in use. The effluent water from the septic tank contains a large quantity of organic matter in solution; and this water is passed through an intermittent filter for further purification; in fact, the septic tank method of sewage purification is really only a method of preparing sewage for intermittent filtration by liquification of most of its organic matter; it is not a complete system in itself. It must be operated in connection with an intermittent filter for complete purification of the sewage. About 700,000 gallons of sewage per day can be purified by means of the septic tank and intermittent filtration system. This system requires far less space than any other system of sewage purification, and is much cheaper to operate; in fact, it is almost automatic in its operation. The care it does require, however, is of the skilled and intelligent kind, and, like the working of a locomotive, none but skillful and experienced men should be entrusted with its operation. This system of sewage purification has been used in nearly all plants built within the last few years in both large and small cities in this country and in Europe. Manchester, England, a city of 600,000 people, is the largest city which now uses this system.

Partial decomposition of organic wastes in the septic tank followed by complete decomposition in the intermittent filter is the result obtained by many years of experiment and trial in the efforts to purify sewage; it represents the latest accomplishment of sanitary science, and while still somewhat in the experimental stage, the results obtained indicate that the methods of this system is in line of progress which will probably insure the cheapest and most efficient manner of sewage purification.

SEWAGE DISPOSAL AND WATER PURIFICATION.

By John N. McClintoch, Consulting Engineer.

Cleanliness is next to godliness. The laws of sanitation follow closely those of morality and are of equal value in benefiting the temporal condition of our race. If they are neglected the people suffer and charge their unhappiness to an overruling Providence, when the blame should rest on themselves for neglecting the laws of personal and civic cleanliness.

JOHN N. McCLINTOCH, M. AM. SOC. C. E.

The first sanitary engineer of record, when the Hebrews marched out of bondage and were guided toward the Promised Land, laid down for his people a law of sanitation which the accumulated wisdom of the ages, gained by experience, pronounces good even to this day. Moses ordered the Jews to bury their wastes, lest the Lord see any unclean thing in their midst and turn away from them in anger. He did not direct them to convey their refuse outside the camp and pollute the surface of the earth and the air, or to turn the sewage into the river or into the nearest spring of living water. To the ancients water was the emblem of purity.

It has been known for ages that the earth absorbed in time whatever of corruption was consigned to it; but that occasionally the process was attended with the contamination of the ground water. Engineers, scientists and city officials throughout the civilized world have for years been studying and experimenting on the problem of how to dispose of town and city sewage in such a manner as not to give offense. A solution of the problem of sewage disposal, providing at the same time a method of purification for water, has been discovered which is so simple that the wonder is that it was not put in operation years ago.

It was not fated that the discovery should be made by any of the bodies of learned and scientific men in any part of the world, although large sums of money had been intrusted to them to conduct the most exhaustive experiments, solely for the purpose of making the same discovery—the proper disposal of sewage. Neither was it the result of chance. Many years ago an elderly man, far on the down-hill path of life, observed that a peculiarly constructed cesspool, which he had built for his own residence, was automatic in caring for the solids which were deposited therein. After watching it for five years, he found that no

solids accumulated. Then onward, with this basic idea aided by a succession of expert engineers, he continued his studies and researches until he had evolved a perfect system of sewage disposal and water purification, which he proclaimed to the world officially as his discovery. His great life-work accomplished, he was gathered to his fathers in the fullness of years and of honors. There is no danger of the credit being wrested from him, as for years he stood alone in his faith and belief until, toward the close of his life, he had brought many people to accept his theories. History and the scientific world will do him justice—if, as Achilles, he ever has a Homer to sing his praises. Charles Levi Woodbury quotes in one of his Fishery pamphlets from the journal of the official English discoverer of America, that when he arrived in a port of refuge to discover and to take possession of the country in the king's name there was a fleet of fifty vessels anchored there before he came into port; a fact which is noted to show that history even becomes a matter of official record.

The system for sewage disposal consists of—

1. A water-tight settling or septic tank, large enough to hold from eighteen to thirty hours' flow of the sewage, through which the flow is constant, but so constructed that the outlet draws neither from the top nor the bottom of the tank.

2. The effluent from the settling tank is received on the top of a coarse coke, cinder or gravel filter at the rate of one cubic yard for every hundred gallons of sewage per day. The sewage from the tank may be applied continuously or intermittently to the filter. The filter may be used in sections, the one operating while the others aerate, or may be used as contact bacteria beds which gradually fill up, rest and slowly discharge.

3. The discharge from the coarse filter may be received on the surface of a finer cinder or sand filter intermittently, with at least one cubic yard of filtering material for every three hundred gallons of the effluent from the bacteria bed. If one cubic yard of the fine filter is provided for every hundred gallons of effluent per day, the purification shoud be absolute, as soon as the filters get into working order.

In other words, sewage disposal works should provide rotting or settling tanks, which contain half a cubic yard of space and one cubic yard of coarse filter, and one cubic yard of fine filter for each and every inhabitant—about the amount of territory assigned for man's last resting place, the grave.

For sanitary, sentimental, as well as for other reasons, it is well to protect the tank by a roof or covering and ventilate it, although the ventlation is not essential. A covering may or may not be placed over the two filters. There is no chemical or biological objection to their being covered by a layer of loam. The finer filter need not be protected; for the effluent which it received from the septic tank and bacteria bed is colorless, odorless, and tasteless. The fine filter may be omitted when the discharge is into salt water.

To explain the working of this system it is necessary to state that bacteria of putrifaction and nitrification originate with the sewage. The former are known as anaerobic bacteria, which work without air and include the germs of malignant diseases. The septic tank may be likened to the stomach, and the action of the bacteria to digestion. These bacteria vastly increase in numbers under the conditions offered in the tank, and having served their purpose, disappear. They act, during their brief existence, to disintegrate organic matter and convert it into its original inorganic elements, in some such a way as combustion. Very little of the suspended organic matter of the sewage escapes from the tank, about 10 per cent. of the dissolved organic matter and only about 15 per cent. of the number of the bacteria which enter. Those which do escape are chiefly the amphibious or facultative bacteria, which operate either with or without air, and the aerobic bacteria, which require air. Those which do escape become attached to the surface of the filtering material and are sustained by the dissolved impurities which come with them. The best filtering material is that which offers the best surface for the bacteria to become attached to. Charcoal or coke proves as good as any, although cinders and burnt clay are very efficient.

Some bacteria escape from the coarse filter, are arrested in the fine filter, and continue their functions of converting the dissolved impurities into plane food or inorganic elements. Doubtless there is in both of these filters a chemical as well as a biological action; for intermittent action introduces air throughout the filters, and it is possible that the bacteria having done their work become oxydized or consumed; for certain it is that the temperature of the sewage going through the works perceptibly rises.

The above theories are advanced to explain what are now recognized as well-established laws of nature. As the tank is like the stomach, the bacteria beds are like the lungs on an animal, inasmuch as the air goes through the filter at regular intervals; for as a matter of course the system can be made to work automatically, its action depending on the bacteria of the sewage, the flow of the sewage controlling its diversion from one bed to another by as simple a mechanical device as the shut-off of a bath-room tank; while intermittent action in the fine filter is obtained by means of a syphon which slowly empties the coarse filter when it becomes thoroughly saturated.

The bacteria of the sewage as it enters the tank number about 1,000,000 to the cubic centimeter. As the sewage is brought to rest in the tank, these gradually increase to 50,000,000. It is supposed that nothing of an organic origin can withstand the action of these bacteria of putrification, so that it seems probable that the septic tank will finally settle the problem of garbage as well as of sewage disposal.

At the experimental plant at Brentwood, N. H., which has been in continuous operation for five years, the septic tank is protected by an ordinary roof, and is remarkable from the fact that septic action there does not give forth offensive or noticeable odors in the building itself which, however, is ventilated into a shaft. The manurial

value of the sewage may be saved and utilized as a fertilizer, as at Brentwood, if it is desirable, by constructing the tanks with partitions, the first compartment holding the bulk of solids in such quantity that putrifaction is arrested. A common precipitant like lime will increase the deposit. This system conforms to the Mosaic law inasmuch as it leaves the waste and refuse of the city beneath the surface of the earth and leaves to nature, assisted by the art of man, the sanitary disposal of the sewage.

The septic tank on a large scale was first proposed for the city of Brocton, Mass., in 1887, and is thus summarized by the officials who condemned it: "A settling basin, which without the aid of chemicals is intended to separate and retain the solid portions of the sewage; with four divisions of this apparatus to allow for cleansing; all to be covered by a building having a central shaft or chimney for removing foul odors."

"The scheme as proposed is thoroughly impracticable. The settling basins would not cause the suspended matters to settle to a great extent."

The next attempt to install a plant of this character was made in 1895 for the town of Andover, Mass., and consisted of "two sets of double collecting tanks and two filter beds, thoroughly underdrained, within a building ventilated through a four-foot chimney seventy-five feet high, the effluent to have intermittent filtration out of doors through one and one-half acres of prepared filter beds underdrained, with three feet of sand covered with three inches of loam receiving the sewage from overdrains; or such a building without out-of-door filter beds."

These tanks, as designed, would hold the flow of twenty-four hours and the coarse filters would receive the effluent at the rate per day of one million gallons per acre, while the out-of-door filters would receive the effluent from the first filters at the rate of twenty-five thousand gallons per acre per day, at the rate the sewage comes to the disposal works at Andover today, after the sewers have been built and in use for over two years. The system was received with the following welcome: "The Board has carefully considered the proposed scheme, and finds that it is a thoroughly impractical one for the disposal of sewage. The settling tanks cannot be expected to remove more than a very small portion of the suspended matters. Moreover, there would be a constant flow of sewage through the proposed tank, while in the case of the experiments at Lawrence, the liquid was not disturbed. The indoor filter beds are altogether inadequate and would very quickly become clogged. The filtration area outside would receive sewage from which only a small proportion of the organic matter had been removed. No special chemical or biological difficulties attend the purification of sewage by this form of filter. An area of about six acres of open filter beds properly prepared would be sufficient for the town in the beginning, but it would be desirable to provide for increasing the area when necessary."

The principle and action of the septic tank in liquefying the solid suspended matter in the sewage was not of common or even scientific knowledge at that date, 1895, so its development must be looked for within the last five years.

The 1898 report of the Massachusetts State Board of Health, published in the fall of 1895, contains a full report of the experiments carried on at the experimental station to test the workings of the septic tank and biological filters, and confirms all that was ever claimed for the system as to the degree of purification obtained. The water from the bacteria beds at times is freer from contamination than that of the Merrimac river at Lawrence, when it is pumped and filtered at the rate of three million gallons per day to be delivered for use for domestic purposes. On account of the septic action of the tank the filters will operate for a very long time, perhaps perpetually, because those in use for more than two years show no indication of becoming clogged. A sewage disposal plant has recently been constructed at Liberty, N. Y., where the septic tank holds from twenty to twenty-four hours' flow. The coarse filter received the septic tank effluent at the rate of 800,000 gallons per acre per day, and the secondary filter receives the effluent from the primary filter at the rate of 1,600,000 gallons per acre per day. The tank is covered by a concrete roof, but the filters are open. The purification effected is perfectly satisfactory to town and state authorities.

The septic tank and single filtration is in operation at Andover, Mass., and the tank reduces the area necessary for filtration from six acres, demanded by the state officials, to less than half an acre, and effects the most satisfactory purification of the sewage, equaling that where broad filtration is used without septic action.

Sewage disposal works with double filtration without septic action are being constructed at Houston, Tex., but are not yet in working order.

Now to apply this principle or apparatus to the purification of water. If the health authorities of a municipality come to the conclusion that the water furnished is a menace to the citizens and needs purification before offered for domestic purposes, a delay in erecting a proper purification plant is almost criminal. Officials should act quickly and not stop to experiment. An experimental station has been conducted by the Commonwealth of Massachusetts from 1887 up to the present time, and the results of the experiments in the use of various material in the purification of water are given in full in the exhaustive reports of the Massachusetts State Board of Health for the years 1890 to 1898 inclusive, which are probably on file in the nearest public library and which should be, if they are not, in the library of every city engineer.

When one first draws water through an iron water main there is present in the water unmistakable evidence of iron and iron rust, which, however, soon disappears. If there were not a cessation of chemical action the iron mains for water or sewage would soon become disintegrated, instead of lasting a century or more, when not exposed to the air or to electricity. The the-

ory which explains the long life of the iron water main is that its surface becomes lined with bacterial life which not only protects the surface, but purifies to a certain extent the water passing through. The principle of the filter is that the surface of the filtering material becomes coated with bacterial life; and that filter is best which is best calculated to hold and maintain bacteria. Bacteria are present in the water when there is any pollution, and originate from putrefaction or fermentation from animal or vegetable sources.

The poorest filtering material known is glass or glazed pottery; the best is charcoal or coke. The bacteria find it difficult to cling to the former, while the latter offers an ideal surface. It may be possible that charcoal or coke is the best because of the minute air spaces which they contain. Next in value to coke are cinders, screened to separate the ash; and then comes burnt clay or broken brick. Sand and gravel come nearer to glass than to coke. Generally where an artificial filter is to be constructed near a city cinders are the most economical, for they have no value except for filling and road ballast, and can be run through a crusher and sorted by a rotary sieve to the most advantageous sizes. The finer the filtering material the more extensive the surface for maintaining bacterial life, and also the more liable to become clogged; on the other hand, the coarser the material the less the surface, but the longer the life of the filter, because there is less likelihood of its becoming clogged. Sand is perhaps the most frequently used for a filter because it is the most available. One should be able to purchase from the contractor a cubic yard of coal ashes for 10 cents, and sifted cinders, sorted as to sizes, should not cost over 50 cents a cubic yard. If the ashes were taken from the manufacturing establishments of the city the necessary amount could be quickly gathered. There is very little organic impurity in the ashes, and what there might be the filter, when in operation, would quickly disintegrate and convert into harmless elements. Straining alone does not remove dissolved organic impurities nor a harmful germ from the water.

To filter river water one should take advantage of three natural laws. First, that of sedimentation as it comes to rest in a settling tank where suspended matter might rise to the surface or sink to the bottom. It would be well to arrange this tank in long and narrow channels, from each of which the supply could be shut off for the purpose of cleansing.

Secondly, it would be advisable, if there is much suspended matter in the water, to strain the effluent from these channels perhaps laterally through a three-foot wall of fine coke or cindered continuously, so that the anerobic bacteria could get in their work.

Thirdly, the clarified water from the coke filter might be collected and periodically discharged on the surface of a coke or cinder, gravel or coarse sand filter, five feet in depth, made of material that would go through a quarter-inch mesh and not through an eighth-inch mesh. The surface might be flooded at each discharge, every half hour, to a depth of six inches. In the body of the filter there is about twenty inches air space, so that the six inches of water will be suspended by capillary attraction the whole sixty inches of the filter and be subjected to the action of three times its bulk of air while the aerobic bacteria on the surface of the filtering material will disintegrate the organic impurities brought to them by the water. When the next body of water is poured upon the filter the air and water already there are forced down into the underdrains, the air escaping and the water being collected to be applied intermittently to the surface of the filter of the same dimensions as the first one, but composed of finer material, such as coke, cinders or even sand. If these filters are side by side, two million gallons of water can be purified on one acre; but if land is valuable the filters can be placed one above the other, so that six and one-half million gallons can be purified on one acre per day. A timber and tar gravel roof might be of service during the cold snaps of the winter, in northern latitudes, to protect the filters from the frost; but otherwise it would not be essential, except in some cases over the reservoir receiving the effluent from the last filter.

By this system is obtained the benfit of a settling tank and what of septic action will occur in the tank to liquefy and disintegrate suspended impurities; the straining through three feet of coke or cinders, and the double intermittent filtration of the water through ten feet of prepared filter beds where the water is subjected twice to over three times its bulk of air, and the myriads of bacteria clinging to the surface of every grain in the bed. The lateral coke or cinder filters can be built in bays, held in place by netting and can be replaced in sections when they become clogged by river silt.

Any curious and investigating householder can test the efficiency of this system in the back yard, in the stable, or in the cellar in a crude way. Let him take a small hogshead, fill the bottom with clinkers from his furnace, the next layer with what will go through an inch mesh and will not go through a common coal sifter, and the rest of the space with cinders which will go through a coal sifter and not go through a flour sieve, or with coarse sand or fine gravel. Across the open top of the hogshead rest two joists, and thereon place a wine or whiskey barrel, with perforated bottom to receive an iron syphon and filled with the same material as the hogshead and arranged in the same manner. The syphon is fixed to empty the barrel slowly, when the filtering material is saturated with water, discharging upon the surface of the filter in the hogshead. Above the barrel suspend a ten-quart wooden pail, as a tip bucket, so arranged that when it is full of water it will discharge its contents upon the surface of the filtering material in the barrel, and when empty return to its original position to be refilled. Next arrange the faucet of the garden hose so that it will fill the bucket in twenty or thirty minutes, and let it run for a few days until the filter gets into good working order, leaving the outlet at the bottom of the hogshead open. When the water runs pure and sweet, purified in nature's laboratory, artifically prepared,

the experimenter can let enough water run to supply the daily needs of the family and then shut off the supply. This filter can be arranged so that when the water rises to a certain hight, in the reservoir in the bottom of the hogshead the supply can be cut off automatically. Any ingenious plumber can design and construct the apparatus. When the filtering material in the barrel becomes clogged by the river silt, as it undoubtedly will in the course of time, it must be renewed. This design, if carried out, may possibly preserve some life which otherwise might be sacrificed while awaiting experiments by the city officials. A few days and a few dollars would demonstrate the value of this principle, but every day of delay means danger to citizens and those tarrying in the town. No one should offer water to drink which is known to be polluted and dangerous to health, under any circumstances.

After constructing your water purification plant where necessary, let the city or town build sewage disposal works and take the sewage out of the river, lake or harbor for the benefit and health of those dwelling on the banks. When the city has put in operation the filter and disposal works, all inhabitants living on the water shed should be warned that people are using the water for the water supply, and demand that it be kept pure and free from sewage pollution. There is common and statute law enough to protect the town from the filth of their neighbors, if anyone cares to enforce it.

If the source of water supply is reasonably free from sewage or other contamination, single filtration is frequently all that is necessary. Where the supply is taken from a river which receives surface drainage as well as sewage, too many precautions to guard the purity of the supply cannot be taken. It is well to err on the safe side.

The system of water or sewage purification by double filtration, or by combining the settling or septic tank with single or double filtration, permits any community to enjoy the blessing of pure water and may prevent their polluting by sewage any body of water which may be a source of water supply to their neighborhood. It permits, on account of the small area necessary to be used for water or sewage purification, that the territory employed for carrying out the scheme may, above the surface, be devoted to other purposes, such as recreation grounds, parks, gardens or lawns, and prevents what is usually an offensive operation from becoming a nuisance in any neighborhood.

The Mississippi river, the Father of Waters, with its thousands of tributaries draining a continent, is naturally the fountain of youth which De Soto sought. Its water is remarkable in that it will purify itself in time, and can be carried around the world without becoming putrid under the tropical sun. As the population of the valley increases, the danger of contamination increases; and to guard the health of the people its pollution should be prohibited. True, its bulk is vast, but bacteria of disease and putrefaction have a wonderful prolific way of increasing in numbers, as is shown on the culture plate, and the water my carry the germs of diphtheria and tuberculosis as well as the typhoid, the cholera, and the black death, the bubonic plague, and spread the scourge over the continent. Some of the germs of contagious diseases are known to withstand the rigors of a northern winter, and are revivified by the summer sun, after having been inclosed in blocks of ice. They are most active in the water when the lake is covered by its wintry coat of ice. The water-shed of the great lakes, like that of the Mississippi, should be exempt from the effects of sewage pollution as far as it is practicable, and its waters should be a reservoir of the life-giving element for the use of all.

The time is approaching when the national government, as well as the state and municipal governments, must take this matter in hand, and enact laws to protect the health of American citizens, as well as their "life, liberty and pursuit of happiness," guaranteed by the constitution, for of what value are all these without health? The interstate rivers and lakes are especially within the jurisdiction of the general government; and it is suggested that the next new member of the cabinet should be the secretary of the public health.

MUNICIPAL SEWERAGE SYSTEMS AND ASSESSMENTS.

By Geo. T. Bouton.

It is now a well accepted fact that good sanitation is a necessary essential to the continued good health of communities, and a consequently important contributing agent to their prosperity and growth. In the last decade vast strides have been made in the practical application of sanitary science, and this, supplemented by intelligent municipal supervision, has revolutionized old methods to the great and lasting betterment of those municipalities where sewer systems have been established and perfected, and when perfected adhered to.

The average city is of comparative slow growth, and its initial provision for sewerage purposes is usually of such limited character that it can hardly enter into and become a part of a comprehensive municipal system which increasing population and probable additional territorial acquisition is sure to demand; nevertheless such additional system, primitive and utterly inadequate though it may be, is in many cases permitted to remain as a perpetual menace to the welfare and health of a community, because of the expenditure which would be necessary if it were to be supplemented. It has been well said that "the strength of a chain is but that of its weakest part," and the application can be made to a municipal sewer system which, though magnificently planned and honestly built, is dependent for outlet on antiquated structures which not only lack capacity

but has been ravaged by time. The first desideratum for a thorough and adequate system should be the elimination of any minor parts, which, while they may have rendered efficient service in the past, could be but makeshifts in the new sanitary era and breeders of pestilence always.

An early duty of the proper city officials should be the adoption of a comprehensive sewer system for the entire city, anticipating therein the natural growth in population and the possible consolidation with adjacent municipalities, and when this shall have been done, adhere to the plan rigidly, unless something previously unforseen should require that it be augmented. In other words, permit of no curtailment. During the period when a city is in its swaddling clothes (so to speak) and aspires to but has not yet reached the dignity which comes with growth, it oftentimes becomes necessary that its outlying sections should be provided with drainage and demand is made by the residents thereof for relief. In my own city this was for many years a source of annoyance and worry. The demands seemed reasonable, proper regard for sanitary conditions prompted favorable municipal action, but sewer systems had been established and the property to be benefited was unimproved to an extent which would not warrant the introduction at that time of the system contemplated by the city for the reason that to burden an unproductive area with an appreciable sewer assessment would result not only in a substantial opposition to the building of it, but also in the non-payment for years of much of the assessment levied therefor. Our law may be peculiar, but it is righteous in that initial sewer construction must be petitioned for and paid for by the property benefited and successful objection may be made by the owners of property liable to more than one-half the assessment levied therefor, the intention being that the benefits equal the assessments and the assessments equal the entire cost. The municipal authorities are vested with powers to establish the system and compel all petitions to accord therewith, but it remains with the owners of property to decide when the sewer extension shall be built. This provision of law is undoubtedly intended to prevent public officials from burdening outlying and sparsely settled sections beyond their necessities and levying assessments at a ratio closely approximating the entire market values. It may be suggested that under such a law disgruntled or parsimonious owners might prevent for an indefinite time the necessary extension of a sewer system, but a notification from the Board of Health with a mild insinuation that neglect may result in indictment by the courts, is always effective.

The solution of the problem as to what could be done to aid those who were pioneers in the building up of the environs of our city was, I have stated, a subject which required much thought. For many years applications were from time to time made by this class of property-owners for permission to construct private sewers and in the absence of any other suggested method, such application was generously granted. The evils of such a course did not at first present themselves, but it eventually became evident that if the city was to have a sewer system which was not a succession of shreds and patches, a radical change must be effected. Owners of property importunate for relief, would, when permission was so granted, construct private sewers of a quality and capacity sufficient to market their real estate, but utterly at variance with the city's system. Then when such sewers had accomplished the purpose of the owner, he would proceed to juggle with the officials for their acceptance as public sewers. The average public official is but human, and with a desire for a continuance of his lease on public life, he would too often yield to the voice of the charmer, who in many instances was a party of influence, and the city would have inserted into its sewer system something of present questionable value and a source of future trouble and expenditure; and this applies generally to every growing city, and cannot but result in the utter ruin of a system however judiciously planned, however well built, unless those in authority will profit by the lesson of experience and adopt forceful measures while the opportunity remains. The city of Jersey City has adopted such measures and now, if some owner desires to build privately, he must do it in accordance with the city's plan and to the complete satisfaction of the city's engineer. When so built it can, if so desired, be immediately turned over and accepted, or it can be held by the owner for a period not exceeding five years. In either event the city obligates itself to collect from those desiring connection a pro rate of the cost of the sewer, based on a filed sworn statement, and that pro rate so collected is turned over to the original owner. The five years' limit is established to prevent an indefinite holding of a semi-public sewer by private individuals, even though the city will during such interim protect against mulcting those who may desire to make connection.

The interests of property-owners are further protected in that if it seems burdensome to construct at the time such form of sewer as is comprehended in the plan of the city, an owner may under certain conditions be permitted to construct for temporary purposes a private drain. But an agreement must be first signed that no objection will ever be made to the construction of a permanent public sewer when the authorities decide that the building of one has become necessary, the further power remaining with the city to compel at its discretion the removal of any private drain. While this new order of things has not been in force sufficiently long to quote results, it would seem to offer an effectual solution of what has heretofore proven a bothersome municipal problem.

The levying of a just and proper assessment for sewer and drainage purposes is a matter which has undoubtedly appealed to every official on whom the responsibility devolved, and, while at first thought it would seem that abutting property should bear the entire cost of sewer construction, an every day practical dealing with the subject or even a slight analysis will soon dissipate any such idea. Unlike street improvement, a sewer should furnish but one grade of service. The degree of comparison should not include better or best. The

standard should be "good," and when a piece of property has been accorded "good" drainage facilities, nothing should yet remain to be performed in that line: hence, if the property has been benefited to the full extent of the facility of the city to so benefit and to the same extent that all properties in the city are benefited, why not make a uniform charge for every lot, averaged upon the ascertained or approximated cost of the system as a whole? In the improving of streets we are privileged to consult the desires of our citizens and property-owners may at their pleasure be provided with the exclusive asphalt, the plebian macadam or those that go between. It is a case of positive, comparative and superlative, governed by the desire and ability to pay, of the taxpayers.

Wholly different is the sewer question. A municipal sewer system must comprehend one or more large main outlets, with connecting laterals of varying size and all necessary to one complete whole. The property abutting on a main outlet should be assured of good drainage facilities, as also should that property abutting on the smallest lateral, but while at times an effort is made to levy a portion of the cost of the main sewer on a considerable portion of contiguous territory, the uniformity of assessment oftentimes fails, and disparity in payment for equal benefits is the rule. A knowledge of affairs in my own city, together with a careful inquiry made into the methods of other cities has forced this conclusion. Now let us consider that the cost of the main outlet has been evenly distributed, there yet remains the laterals of size varying from forty-two (42) inches brick to eighteen (18) inches pipe. The cost is disproportionate, and although the benefit accorded is identical, I believe you will find that the almost unversal custom is to assess the abutting property not with regard to the benefit, which is equal, but on the basis of cost, thus the individual who owns property abutting on the forty-two (42) inch brick lateral, pays in the neighborhood of fifty per cent. more for his service than does he whose property abuts on the eighteen inch pipe. The first individual would be perfectly satisfied with the small pipe sewer, but the city's system orders otherwise and with the method of assessment now in vogue an unfair and discriminating charge is legalized. The remedy suggests itself. Establish your system and regardless of the size of a sewer make the cost for drainage fixed and uniform.

MUNICIPAL HOME RULE, ITS SCOPE AND LIMITATIONS.

By Robert E. McMath, President of Board of Public Improvements, St. Louis.

of Public Improvements, St. Louis.)

The government of cities is a subject of vast and growing importance. When the United States first took its place among nations the three largest cities—Philadelphia, 42,000; New York, 33,000, and Boston, 19,000—had an aggregate population of less than 100,000. The early state constitutions contained no provisions relating to the government of cities, for there was then no need. As the need became manifest such provisions found place in the later constitutions. Of the mass of legislative acts a great part relate to the affairs of cities, towns and villages, and no small part of the labors of courts are given to endeavors to define the rights, relations and duties of municipal corporations to their inhabitants, to the state and to the persons or corporations having contracts or business relations with municipalities.

A considerable body of literature has been produced devoted to the discussion of municipal problems, which might be studied with profit, but comparatively few municipal officers have opportunity to make such study. The American Society of Municipal Improvements has properly charged one of its standing committees with the duty of making a report on city government and legislation. The objects of this society are practical and the treatment of the assigned topic should be to find what is rather than speculate as to what ought be.

Of the nature and properties of a municipal corporation it has been well said "There is nothing in the law more complex and abstruse," and again "Our municipalities in their creation and operations stand closely related both to the state and to administrative law. They offer to the statesman, the legislator and to the jurist questions of perplexing intricacy and deepest moment. How thoroughly our municipal institutions are wrought into the framework of our government and administration, how important the functions they are made habitually to perform, how closely in the exercise of their diversified powers and in the discharge of their varied duties, they touch the daily life and affect the most important interests of the citizen and of the property-owner cannot fail to impress the most inattentive observer."

The whole system of government in the United States is intended to be one of checks and balances. Limited powers are granted to governmental agencies for specific purposes, and the residue of powers not so delegated is reserved to the people. In accord with this general policy the right of local self-government is expressly asserted as inviolable.

We have a series of governmental agencies: A federal administration to which is committed all matters relating to other nations and such internal affairs as touch all parts of the country alike. Secondarily, but not subordinate in the sense of being subject to dictation as to local policy, comes the state, which has full power over the conduct and interests of the people of the state, but the power is defined and limited by written constitutions. Next we have in most states counties, which are political subdivisions of the state, subordinate to and auxiliary to the state government. Counties are vested with powers to manage certain local affairs, but since counties do not have legislative powers they are little more than local agencies of the state. Next in order

comes the municipal corporation, (a term which includes cities, towns and villages), whose functions are restricted to a defined territory lying within the state and usually within a county. Some few cities are in some respects counties, or perform duties to the state as if they were counties.

Municipal corporations have their powers and duties defined by constitution, charter or statute, and the construction of these powers and duties is strict. Among the powers is that of establishing, by ordinance or by-laws, local regulations governing the conduct of persons in many matters relating to the municipality, and of punishing those who violate such regulations; of raising revenue by taxation and otherwise to bear expenses of the local administration; of determining the advisability of making local improvements and the manner and extent of the same; of guarding the public health; of caring for sick and helpless persons; and generally to do anything not inconsistent with the constitution or statute of the state or nation that will promote the prosperity, welfare, comfort, convenience and pleasure of the people of the city.

As duties usually cities are required to act as the agent of the state in the maintenance of peace and good order within their bounds, and for these purposes to maintain a police force.

A fundamental principle of the system of government is to bring the details of public business close to the community specially interested so that matters of merely local interest should be locally controlled.

This principle is what is known as home rule, as distinguished from control of local affairs by a distant general authority. The American conception of home rule is that each locality shall choose its local officers and manage its purely local affairs without restraint or supervision by a state authority. In some other lands the idea is modified by more or less supervision by a central authority. Whether the unrestrained home rule of the American idea, or the restricted home rule of the foreigner is the better is a subject of unlimited discussion.

The ideal home rule is very imperfectly realized in American cities, partly because of state interference, partly because courts do not stand consistently upon a sure ground of interpretation as to the scope and limitations of home rule, and partly because the people of our cities tolerate much misgovernment.

Some thinkers and writers lay the evils of corruption and fraud to the substantial citizen who neglects or refuses to perform his public duties. Substantial citizens in one sense of the word are usually directly responsible for corruption, for no one is corrupted unless there is a corruptor who either tempts or submits to improper demands. In fact, the evils which result from the incompetence of officials are as bad and possibly more numerous than those which come from willful dishonesty, but the situation is much aggravated if incompetence and dishonesty exist together. The substantial citizen who is careless, pessimistic or unwilling to give of his time, means and labor for the public good must bear the responsibility for both classes of evil. But how can the substantial citizen be reached and reformed? Consideration of this question is not pertinent to this report.

In England the right of home rule has existed from the earliest date of authentic record. The Norman conquest overthrew the old order and was followed by the feudal system, but under that system a limited species of home rule was exercised. The Norman city charters conferred the right to protection of person and property rather than the right of local self-government. Magna Charta restored the old rights. "Let the city of London have all its old liberties and its free customs as well by land as by water. Besides this we will grant that all other cities and boroughs and towns and ports have all their liberties and free customs."

The struggle on the part of cities for more freedom on one hand and on the part of the central power for more control over the cities on the other hand has long existed and continues to the present day. On the continent the question of municipal home rule and governmental control has been satisfactorily solved. The rights and duties of municipal bodies have been defined in a way that suits continental systems of government. In England much progress has been made toward the adjustment. In America the lines have not as yet been clearly drawn. Court decisions are conflicting. What is held to be law in one state is not accepted in others and early decisions are not followed in later cases before the same court.

It is not within the province of this report to review the many conflicting utterances of courts at various times of the several states. It is enough to say that decisions have been made which range from the extreme view that municipal organizations antedate the formation of states and that they are and should be free from state control in matters affecting their local affairs to the opposite extreme that municipal corporations are created by the state and are subject to the will of the state. The power to create implies the power of destiny, hence the control. The true relations between cities and the state lie between these extremes.

It is generally conceded that the charter of a city or legislative act granting powers are not contracts within the meaning of the constitutional prohibition as to passage of laws impairing the obligations of contracts. Hence political powers given a municipal corporation for local government are not vested rights as against the state.

Unless there be express provisions in the state constitution to the contrary the legislature has general supervision and control of cities and may enlarge or diminish their corporate powers at will. But there are limits beyond which legislative control may not go. Counties, towns and cities are recognized in constitutions as local agencies as well as agencies of the state. It is generally held that it is not within the power of the legislature to abolish their powers as local agencies and assume such functions to itself or to confer them upon boards, commissions or officers named by the legislature. But the local agency cannot be allowed to have discretionary power to perform or to refuse to perform the duties which the people of the subordinate juris-

diction owe to the state. Assessments must be made, taxes levied and collected, police and the machinery of courts and administration of justice must be maintained. The power necessarily vested in the legislature to exercise control over cities is intended to be used for good and worthy ends, just as the powers of municipal corporations are intended to be so used. The powers may be abused, and in many cases have been abused. If the city abuses its power the legislature may correct, if the legislature goes beyond its proper limits the courts may intervene, but if the legislature goes wrong but keeps within its legal limits the only appeal is to a subsequent legislature.

The legislative control spoken of extends to all the relations which the city bears to the state, but there is a portion of the functions of the city to which legislative control does not extend. It does extend to all things which have their origin and proceed from the act of incorporation, but those things which existed independently of the act of corporation the legislature can not impair or destroy. The United States supreme court has held that the municipal corporation is entitled to the constitutional protection "with respect to its private or proprietary rights and interests." The community has local rights and privileges not created by legislative action. The act of incorporation created a legal personality and invests it with certain powers and privileges, some of which affect the state at large and are of the nature of duties owed the state, others relate to local necessities and conveniences and are exercised or not as the local authority may determine. The real purposes of a municipal corporation is to provide for the popular needs and conveniences of a compactly settled community with which the state at large has little or no concern. The duties to the state are laid upon the city as a matter of convenience rather than necessity.

There are many matters which are clearly local and others as clearly relate to the state, but there are still others whose relation is not so clear. Hence there is much confusion as to where home rule of cities should begin and end. A recognized authority says: "The administration of justice, the preservation of the public peace and the like, although confided to local agencies, are essential matters of public concern, while the enforcement of municipal by-laws proper, the establishment of gas works and water works, the construction of sewers and the like are matters which pertain to the municipality as distinguished from the state at large." To these may be added fire protection, garbage removal, street construction, maintenance and cleaning, markets, hospitals, cemeteries, parks, libraries, museums and other provisions for the comfort, instruction and pleasure of citizens.

In the granting of railway franchises to use the streets it is held that the city acts as agent of the state. The same principle applies to telegraph and telephone and other local public service.

The right of cities to choose their local officers is generally established but the manner in which they are to be chosen or elected is subject to legislative power. The legislature may impose a civil service on cities or cities may adopt such a service for themselves.

Regulation of the appointment or election of officers and the exercise of the power of selection of city officials by state functionaries are very distinct matters. The one is legal and proper, the other is an invasion of the rights of the governed. "The nearer the officers are to the people over whom they have control the more easily and readily are reached the evils that result from political corruption and the more speedy and certain the cure." The foundation principle or assumption is that the people of a city or other political unit are intelligent and virtuous enough to be fully capable of self-government.

If the people who are most directly affected by bad government fall into careless ways, become indifferent and will not correct evils when the power so to do is in their hands, how may it reasonably be expected that a body of voters or representatives who have no direct interest will be wise and by timely action remedy evils which are merely local? If the community affected will not defend itself at home, or if the decent elements are so discordant as not to work together they will have little influence at the state capital.

Municipal officers are those whose duties are fixed by charter or ordinance and not by statute. Officers who have charge of pavements, sewers, water works, parks and public buildings, perform duties which are strictly local. They are the managers of the city's property, used for the common benefit of citizens. The mayor of a city is not a state officer if he only performs municipal functions, but if, by statute, he is made a member of a police board ex-officio, he, to that extent, is a state officer.

The maintenance of a police force sufficient to secure the peace and safety of all within the city's borders, whether residents or sojourners, is a duty to the state. Hence the proposition that the police is a state agency is generally accepted. If it be a state agency the legislature has control and may compel the city to pay the expenses of a police force even if that force is entirely managed by officers named by the state. In a recent instance this power has been exercised as a right to commit a flagrant wrong, and the courts have held that the legislature, being within the limits of its power, no question can be raised, though the action be unwise.

A certain city which politically is controlled by the party which is in the minority in the state had a police department managed by a board appointed by the governor. The number and salaries of the force was subject to local control, but the police board made all appointments. The board asked the city authorities for an increase of the force, which was admitted to be needed. The request was met by a demand that the members of the city legislative body name the men to be appointed. This was done for several years, and so provocation was given. The police board appealed to the legislature and obtained a new police law which gave the police board almost unlimited powers, and at the first step the cost of police service was advanced from about 19 per cent. to 30 per cent. of the city's revenue. The de-

mands of the police board were made an absolute obligation to be satisfied in full before any municipal need can be provided for. As a consequence of this exercise of legislative control the city is impoverished to the extent of total cessation of all new improvements—is even unable to take decent care of existing streets, bridges, sewers and public buildings.

This case is cited because it presents in concrete form a comment on all theoretical discussions of home rule and legislative control. It shows the possibility that local government and legislature may both take a wrong course. No system of government can by checks and balances prevent untold evil if the administration of affairs falls into the hands of reckless partisans, of men who blindly follow a selfish leader, or of men who are corrupt.

Civic virtues must be in active exercise or the community will suffer.

Home rule in American cities is not clearly defined. Constitutional safeguards are evaded and set aside by strained constructions until little is left except that cities are free to manage city properties, water and gas works, sewers, improved streets and in general the things which the city may do without if it chooses. In all other things the city is under the shadow of legislative control.

Respecting the effect of growing legislative interference with city affairs, Prof. Goodnow says: "The continual interference of the legislature in municipal matters is gradually depriving the cities of the United States of almost all local self-government so far as the determination of the policy of the city is concerned. In those states where such central interference has been most marked the people of the cities have very largely lost interest in municipal government, and whenever they desire to see some concrete municipal policy adopted their point of attack is the state legislature rather than any local or municipal organ."

Mr. Seth Low also says: "This interference though often prompted by a desire to relieve a city from pressing evils, has tended very greatly to lessen the sense of responsibility on the part of local officials and upon the part of the communities themselves."

From this study of home rule, its scope and limitations, the only conclusion that can be drawn is that cities may well be relieved from the discharge of duties in which they act as agencies of the state and be limited to the purely local affairs which provide for the needs of a compact population. The field for municipal activities would then be defined, and energies being concentrated upon definite objects would be more effective than they have been or will be if the field is as broad as many have thought home rule should embrace.

This limitation of home rule will help to differentiate the local affairs of cities from the changing policies which logically attend the combination of functions as state agencies with the conduct of local affairs; will help to emancipate city governments from the domination of national and state political organizations. So long as cities are called on to act as agencies to carry out the will of the state just so long will the political control of cities be striven for by the great political parties and local interests be held subordinate to general politics.

It is a common delusion that our system of government can be understood by a study of the written constitutions of nation and state and of city charters. The real control of governmental action and the shaping of policies has passed into the hands of those who by consent or by usurpation have control of party organizations, which have no place in constitutions or charters and have slight recognition in laws.

To follow the topic further would lead to arguments that would savor of politics and introduce discussions not within the province of the American Society of Municipal Improvements.

CEMENT TESTING FOR MUNICIPAL WORK.

By Horace Andrews, M. Am. Soc. C. E., Albany, N. Y.

Methods of testing cement have been formulated for a number of years, and although they may be deemed susceptible of improvement, and are now the subject of review by a committee of the American Society of Civil Engineers, it is generally acknowledged that the tests now in use are sufficient to enable a pretty correct opinion to be formed as to the value of any particular cement and of its adaptability to the purpose for which it is proposed to be used. The results obtained by the existing methods of testing are subject to a large amount of uncertainty when tests made by different individuals are compared. The divergence of results from different laboratories would furnish an interesting field for inquiry, if new methods of testing are to be adopted. Theoretically, the results from tests made by different persons using the same apparatus and the same cement should agree; if a large difference is found to exist, it would indicate that the methods of carrying out the tests have not been sufficiently well defined.

In municipal work, and more especially in the municipal works of our smaller cities and villages, there are a number of practical difficulties in the way of properly testing cements. It is the purpose of the writer to indicate some of these difficulties and to suggest methods whereby they may be overcome. The municipal engineer has the supervision of the work carried on by a number of different contractors using a diversity of material whose quality must be ascertained by the engineer. His problem is quite different from the engineer who directs a single large work of construction; in this the brand of cement is rarely changed, the materials are furnished in large quantities and ample time is given the engineer for properly ascertaining the quality of the cement.

In municipal work it is very frequently

the case that the construction of sewers and the paving of streets are ordered to be carried out with very little delay and the various works must be let to persons who will not only provide the labor and tools, but will also furnish all the materials. Storage room must be found by the contractor, and generally the only available room is on the street, where he is cramped by the necessities of traffic and of keeping open means of access to houses and places of business. Often the contractor has to work under a time limit and is subject to forfeiture in case of delay. His materials are frequently slow in reaching him from causes quite beyond his control, and when

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they finally are available the citizens, exasperated by the delay and the serious inconvenience resulting therefrom, are as loath to incur further loss from interrupted business as the contractor is to have a forfeiture exacted. The engineer has to adopt one of two alternatives; either to hinder the progress of the work to an extent that will occasion much public inconvenience and perhaps loss to the contractor, or else to pass upon the quality of materials without sufficient time elapsing to enable a good judgment to be formed as to their quality. Time must be given to the proper testing of cement and its absence is the main cause of the difficulty in carrying out proper tests for municipal work.

A second serious difficulty in our smaller municipalities is due to the frequency of the needs of tests. To equip and maintain a testing laboratory involves an outlay that municipal legislators are reluctant to make where it is evident that its use will be quite frequent. Moreover, even if properly equipped testing apparatus is at the disposal of the engineer, there will not be enough work under ordinary circumstances to enable any of his employes to acquire sufficient skill in making tests to render their results comparable with those of persons of large experience and constant practice.

It is well nigh useless for an engineer to specify certain numerical limits in the testing materials when the methods employed are capable of yielding results of very great uncertainty, due to the lack of experience of the person conducting the tests. His tests might reject cements that could be proved by the contractor or the manufacturer to fulfill all requirements when tested by skilled experts. On the other hand he may accept cement, which the larger experience of those engaged in the daily testing of materials would find to be inferior in quality. In brief: A municipal engineer may find himself quite unable to have materials properly tested, owing to lack of time, and often, also, to lack of proper apparatus and skilled manipulators of such apparatus. It has for many years seemed to the writer that the above conditions are the proper subject of co-operation on the part of cities and villages or of intervention on their behalf on the part of the state.

The state engineer and surveyor of New York has recently recognized the existence of this need and has offered to make tests for public officials of the state who will send specimens of cements to his laboratory. Such tests would be very valuable from the fact that they would be made by persons skilled in the business, and they would avoid the entire needless duplicating of apparatus. The most serious difficulty, however, that of insufficient time for proper tests, is increased more than diminished by the necessity of sending samples to a distant laboratory.

The writer would suggest that all cements should be tested near their place of manufacture, if possible, and that the packages should be officially sealed and marked as to their quality. Purchasers could then buy cement with a clear understanding as to its quality and the large amount now expended in feeble and hurried attempts to test cement used in municipal work could be saved. Further advantages would arise from such testing from the fact that an important laboratory devoted to the interests of the consumer would be able to indicate the kinds of cement needed for any particular purpose; whether a cement should be a quick or slow-setting, capable of slowly increasing in strength or of rapidly acquiring sufficient strength to make its use desirable for grouting the joints of pavement, etc., etc.

Such testing laboratories could be supported by a number of municipalities combining for the purpose and who would be the sole beneficiaries, or by the state in which the manufactories are located. In the latter case the expense of such testing could be covered by a sufficient fee exacted from the makers and all purchasers alike would reap the benefits derived from the certainty of quality.

On behalf of the smaller municipalities and the many consumers of cement who are not able to make proper tests, the writer would urge upon this association that some action be taken looking to co-operation or to the official testing of cements of the state.

UNIFORM ACCOUNTING AND NATIONAL MUNICIPAL STATISTICS.

By M. N. Baker.

The chief difficulty in the way of securing comparative municipal statistics is an utter lack of uniformity in municipal accounting, and, worse yet, in many cities, an absence of any sort of bookkeeping worthy the name. It is unusual for any two departments of one city to have the same general system of accounts; rare, indeed, for similar departments in two cities to follow the same plan; and practically unknown for any two American cities to have similar sets of books through all their various bureaus and branches of government. Assuming that we are all of one mind as to the lack and the need of uniform accounts and the advantages of national municipal statistics, let us pass at once to a consideration of the best means of securing each.

First of all, we must rely on state rather than national action to bring about the needed reforms in municipal accounting. In fact, with proper state supervision and audit of municipal accounts, with returns to each state by its several municipalities and the publication of those returns as state documents the need of national action would be reduced to a minimum, the department of municipal statistics at Washington being a sort of national exchange for the several states. The work of the state would be constant and its published reports annual, while the great exchange at the nation's capital might issue summaries at longer, but regular intervals. The idea I have in mind was well expressed a few weeks ago by Prof. Charles Hull of Cornell university, who said the several states might form registration bureaus for recording the flow of the municipal stream, while the general government took cross-sections at fixed, recurring periods.

There are two general lines of possible state action to the end in view: (1) Special commissions, each in charge of a single class of municipal activities, like some of our street railway commissions, or the Massachusetts Gas and Electric Lighting commission; and (2) general boards of municipal control, as was proposed in a bill introduced in the New York legislature a few years ago. Either of these plans involves not only an oversight of accounts, but more or less supervision of municipal methods; and even technical advice, as is given by the Massachusetts and Ohio state boards of health. An intermediate plan is a state examiner, an auditor of public accounts, such as has existed in Wyoming since its adoption of a constitution and admission as a state.

I am not going into the merits of these plans, further than to say that all branches of municipal activity need some central supervision and that greater harmony and unity between the various branches might be expected under one general state board, either of control or audit, than under a number of such boards. One of the greatest drawbacks to municipal progress in America, I may add, is a lack of co-operation between city departments. Our cities do not act as units, but as aggregates of units, each of the many branches or bureaus struggling, as indeed it must under the circumstances, to get its share of the appropriations, like so many pigs at a trough—and sometimes "it's the still sow that gets the swill."

Instead, then, of discussing what sort of state bureau can best serve the end in view let us consider what information municipal accounts and reports should contain. It is the function of societies like this to indicate, after careful investigation, what information engineers and other municipal officials need, leaving it for expert accountants to draw up the necessary systems of bookkeeping. I may say, though, that special stress needs to be laid upon having all accounts discriminate between cost of construction, operation and capital charges, and that the latter should include sinking fund and depreciation.

Your committee on municipal data has already laid before you carefully prepared schedules for reports on water works, sewerage and paving. I desire to call your attention to the fact that water works schedules were prepared some fourteen years ago by both the American and New England water works associations, and that a number of cities in New England, New York, Ohio and Michigan have made use of the New England schedules for years. Obviously, we shall not secure uniformity if each of the various societies adopts a form of its own, with little or no regard to the other. The action of these three societies, in this particular respect, was not intended to be diverse, so far as I know, but nevertheless they have not acted in concert. The three forms have much that is practically identical and their aim is the same, uniformity, and thus comparability. Inasmuch as the Central States Water Works Association will discuss this general question at its meeting at Columbus next week, and the New England Water Works Association holds its annual convention at Rutland the week following, your society has an opportunity to take a long stride toward uniformity by devising some plan for combined action, so that hereafter there will be one, instead of three, or possibly four "uniform" schedules for summaries of water works statistics. The fact that the New England water works schedule is the only one thus far put into use, even though adopted by a comparatively few cities, entitles it to careful consideration by the other societies. It would be surprising if it did not need alteration or extension at some points, to meet the changes in water works practice during the past fourteen years, but we might congratulate ourselves if half the water works of the country presented anything like so complete a summary as this in their annual reports. By far the greater number of water works in the United States are in cities of 20,000 and under, where for many years to come it would be difficult to secure the voluntary adoption of elaborate schedules.

I know there is much to be said in favor of providing very complete forms, not expecting the smaller places to use all of them, but over-elaborateness will lead many

places to avoid these schedules altogether, rather than to select some portions of them for use. Then, too, if the smaller places adopt only portions of schedules, they will not all use the same parts, so that great diversity will still prevail. It should be remembered, too, that such schedules as are under discussion are designed as summaries of statistics, and not for the full body of accounts and records kept by water, sewer and other city departments. Uniform accounts, or bookkeeping, is quite a different thing from uniform summaries of the leading facts relating to water works plant or sewerage system. Eventually, we may hope for complete uniform systems of bookkeeping, but at the start we shall make more progress if we all agree on the leading items which it is desirable to include in the annual reports. In other words, the plan for voluntary action must be simple; the more elaborate schemes for uniform municipal accounts can be brought into general use through central state supervision, with a fair degree of compulsion available for use in some cities.

Of course this society will not stop its efforts at co-operation with water works reports. So far as I know, you are pioneers in formulating a scheme for reports on sewerage and paving, but there are other national societies interested in these subjects, to say nothing of the hosts of state and local engineering and other societies, each and all of which can do most effective missionary work with state legislatures and municipal councils and their individual members. There are a number of societies devoted to special branches of municipal work, branches from which your actual membership is small, but your possible future membership is large—such as gas, electric lighting and street railways. In addition, there are economic and state associations, and still other societies devoted to the general problem of securing good government. What I hope to see is committees from every society interested in municipal affairs, each empowered to co-operate with the others to secure the formulation and adoption of uniform schedules for summarizing municipal statistics of all kinds, and eventually the establishment of uniform municipal accounting, under competent state supervision.

Under existing conditions the outlook for national municipal statistics of much comparative value is not encouraging, but the recent demand for such statistics, and the awakening to the deficiencies in municipal bookkeeping, are each hopeful signs for the future. Until we have a permanent census bureau, or a division of municipal statistics at Washington, it is useless to expect much from the general government, unless it be by an extension of the work of the United States Department of Labor. The department will soon publish its second annual bulletin, entitled, "Statistics of Cities." These bulletins are now limited to cities of 30,000 population and upwards. They might well be extended to smaller cities. The statistics given are secured, for the most part, by agents who visit the cities in question. In no other way, it is said, can facts and figures of value be obtained, under the present heterogeneous condition of municipal accounts and reports.

What the twelfth census might do, is to place before the country a census proper, or mere count, of municipal activities, exhibiting in one comprehensive table the area of each city, its mileage of streets, paved and unpaved, of sewers, water works—and so on through the list, so that anyone could tell at a glance just what a given city had done in any line or all lines of municipal work. This would furnish a valuable basis for more detailed future investigations.

THE QUESTION DEPARTMENT.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

FILLER FOR BLOCK PAVEMENTS.

I would be thankful for any information in regard to filler on paving block.

George H. Randall,
City Engineer, Oshkosh, Wis.

The principal materials used for filling joints in brick pavements are sand, cement, grout and tar or asphalt mixtures. The objects of a filler are to keep water out of the foundation and to protect the edges of the brick from wear. If bricks are closely laid and well filled, any filler which will not run into the foundation will attain the first-mentioned object. Sand of sufficiently fine grain is as successful in this way as more expensive materials. If pavements are not kept clean, there will not be much wear of edges with sand filler; but if they are well swept or cleaned with the pneumatic sweeper, the sand filler will be swept out of the joints near the surface, and the unprotected edges of the bricks will be subjected to wear, so that the upper surfaces of the bricks will become rounded and the pavement rough. The same will be true of tar fillers, and of most asphalt fillers, except that the filler will disappear in hot weather, by running

into the foundation to a greater or less extent. This is not true of all asphalt mixtures. One or two of our advertisers make good filers of this description. A good filler is a grout made of fine sand and cement, applied as a liquid, the first application with, say, three parts of sand to one of the cement, and the second with half as much sand, and applied until all joints are filled. When set, this filler should resist all proper cleaning tools, and if good Portland cement is used should resist the action of traffic about as well as the brick, and thus add to the smoothness and durability of the pavement. Murphy grout, properly made and applied, is equally successful. Some cities have found trouble from expansion of pavements laid thus tightly. Very few have made this complaint when the brick were laid and the grout applied in warm weather.

HOT WATER CENTRAL HEATING PLANTS.

Please give me a list of hot water heating plants, municipal and private, in operation, or under construction, in Indiana, Illinois and Ohio. The city of Columbia City has granted a franchise to operate a heating and electric power system, work to be begun at once, before streets are paved. *L. E. Holderman, Supt., Columbia City, Ind.*

Combination electric light and water heating plants have been erected at Toledo, Ohio; LaPorte, Ind.; Mattoon, and Alton, Ill.; Boone, Perry, Ida Grove, Iowa Falls, Mason City, and Missouri Valley, Iowa; LaCrosse, Kenosha, Portage and Racine, Wis. Some of these were in the nature of experimental plants, but reports from most of them indicate that they are giving considerable satisfaction. Electric light plants in Hoboken, N. J.; Erie, Pa.; Terre Haute, Ind.; Davenport, Iowa; Seattle, Wash., are said to distribute their exhaust steam for heating purposes. Danville and Springfield, Ill., have central steam heating plants. See papers on this subject on page 35 of our July number and on page 351 of the June number. The Central Station Heating Co., Cincinnati, Ohio, will give information regarding its pipe systems. Many franchises have been granted for all varieties of central station heating within the last year or two and about sixteen are in operation.

METHODS OF SEWAGE DISPOSAL

I especially desire information on sewage disposal by cremation. This city is about to enter on a considerable amount of sewering. The plan designed years ago was that of dilution, but increased population and manufacturing interests demand a change if possible. Yours truly,
J. M. Bandy, City Engineer, Greensboro, N. C.

A few small towns in England use the dry closet system, using earth or some combustible absorbent and emptying the pails at regular intervals. The contents of the pails may be used as fertilizer or cremated and the ashes so used. The contents of ordinary privy vaults or cess pools can not be disposed of very successfully in this way. The reports of such systems indicate that they are rather expensive and must be taken care of in the most thorough manner at all times. They are not readily applicable to large towns. The modern systems remove the house drainage by water carriage through sewers to a disposal station where the solids are removed from the sewage by chemical precipitation, filtration, or the action of the septic tank. The solids remaining in chemical precipitation tanks may be cremated if the water is pressed out of the mass. See the answer to question of Frank W. Wagner, for list of books on sewage disposal in this country and in England.

BOOKS ON SEWAGE DISPOSAL AND WATER-WORKS.

Will you kindly advise me of the best works on sewage disposal plants, water-works plants, natural gas piping, etc.?

Frank W. Wagner, City Clerk,
Ashtabula, Ohio.

Rafter and Baker's "Sewage Disposal in the United States" gives short descriptions of all the systems in use in this country up to the date of publication, with some statement of the methods of operation of the works and the success attained. The price is about $5. A discussion of the principles upon which the various classes of systems are based will be found in Kiersted's "Sewage Disposal" ($1.25). English books of great value on the same subject are Crimp's "Sewage Disposal Works" ($7.50), and Corfield and Park's "Treatments and Utilization of Sewage" ($4.50).

Folwell's "Water-Supply Engineering" ($4), and Fanning's "Hydraulic and Water-Supply Engineering" ($5), are the standard works on the design and construction of water plants. Hazen's "Filtration of Public Water Supply" ($2), Nichols' "Water Supply" ($2.50), and Mason's "Water Supply" ($5), treat of the purification and preservation of water, giving full discussions of the sanitary side of the subject.

Probably Rafter's and Baker's and Nichols' will be the best books for your purpose to begin with. Others may follow if other points of view are desired. Natural gas piping follows the same principles regarding the thickness of pipe and method of making joints as ordinary gas piping, and does not depart materially from the practice for piping water, except that allowance for "water hammer" is not necessary.

DRAINAGE ACROSS STREET INTERSECTIONS.

What is considered the best method of providing for drainage across street intersections where no storm sewers exist?

If the street is not paved, a box culvert of wood or stone is usual and is quite as satisfactory as the road surface. The velocity of the water coming to the culvert should be reduced as much as possible, except where gradients are very low, and the water leaving the culvert should be accelerated. This usually means shallower gutters above the culvert and deeper ones with consequent greater crown to street immediately below. The culvert must be large enough to carry the water and there should be entrances to it both in the bottom of the gutter and vertical if possible to arrange. The crown of the cross street should be flattened on the intersection over the culverts enough to cover them completely.

If the street is paved and the amount of water is not excessive it is sometimes possible to use vitrified clay or iron pipe, according to whether the foundation is sufficient protection to prevent crushing or not. Unless the fall across the cross street is great enough to make up for the shape of the pipe, and the amount of water is not large, box culverts may still be necessary. The remarks made above apply almost equally well to paved streets except that wooden culverts should not be used. As a last resort on a flat intersection a culvert whose top is on the surface may be used. No covering other than the street paving material is entirely satisfactory and the choice of material must depend on the character of street surface and kind of loads.

LOSS BY FRICTION IN FIRE HOSE.

What is the loss by friction in a 2½-inch fire hose per hundred feet, and is the factor the same for each additional hundred feet? *Subscriber.*

The friction loss in hose varies directly as the length when laid approximately in straight lines. The loss of head in pounds for rubber hose equals the length of hose in feet multiplied by the square of the discharge in gallons a minute and divided by 2820 times the fifth power of the diameter of the hose in inches. Experiments indicate agreement of results for low pressures and small nozzles and that the results from the formula are a little too small for high pressure and large nozzel. Thus the loss in 100 feet of rubber hose under 20 pounds pressure and with a 1-inch nozzle, discharging 110 gallons a minute, is 4.35 pounds; with 60 pounds pressure and 1¼-inch nozzle, discharging 297 gallons a minute, the loss of head by friction is 29.5 pounds. See Fanning's "Water-Supply Engineering" ($5). The effect of friction in reducing head and discharge is shown in different forms by diagrams, in Folwell's "Water-Supply Engineering" ($4).

CORRESPONDENCE SCHOOLS OF ENGINEERING.

What is your opinion regarding correspondence schools of engineering that are now being brought before the public? Are such schools looked upon with favor by municipalities and practicing engineers, and in your own opinion do you think their methods of teaching will fit a graduate of the school to practice as a competent engineer? I understand their diploma carries no degree. *A Subscriber.*

Correspondence schools certainly do not take the place of the close contact of teacher and student attained in engineering schools, but they are of great value in directing the study of those who wish to secure some technical knowledge, and who can not leave their work, or who can not afford the expense to attend a school. That they supply a great demand is evidenced by the number of schools and the number of students. The amount of work done, and the character of the work, depends upon the individual somewhat more than in attendance schools, and to this extent the average student of correspondence schools is not so satisfactory. Neither is the general training obtainable in the best technical schools to be found in the students of correspondence schools, and this is essential for a thoroughly competent "designing and directing" engineer. Occasional exceptions do not lead to modification of this statement. Unquestionably many studious men and youths have materially improved their position in life by their study under the guidance of the good correspondence schools, and some have been led to take up more detailed and extended studies, and have taken high position, who would otherwise have failed to rise.

MEMBERSHIP IN AMERICAN SOCIETY OF CIVIL ENGINEERS.

What are the requirements of an engineer to become a member of the American Society of Civil Engineers, and what is the expense attached to the Society? *Subscriber.*

The principal requirements for full membership are active practice for ten years, responsible charge of work for five years, ability to design and direct engineering work, age of thirty years, favorable report by five members, recommendation by the board of directors, and less than seven negative votes. There are some modifications under certain circumstances, and the requirements for associate member, associate and junior member are less than those stated. A letter to Charles Warren

Hunt, Secretary, 220 West 57th street, New York, will bring copy of constitution and blank form for making application for membership. The entrance fee for members is $30, for other grades progressively less; dues $15 for members, others less, additional for residents of New York City (within fifty miles of New York postoffice), $10.

[By C. W. Tooke, Professor of Public Law, University of Illinois, for MUNICIPAL ENGINEERING.]

ATTITUDE OF COURTS ON ELECTROLYSIS.

Among the various court decisions regarding the action of municipalities, water or gas companies, against electric companies for damages to gas or water mains to service due to electrolysis, has anything of a definite nature occurred so that such action would be abided by throughout the country? If so, what was the decision?

Subscriber.

I am not aware of any case in this country in which the damage to water or gas pipes by the action of electrolysis has been made the subject of judicial decision. The question is one upon which it is very difficult to give an opinion, and one which in all probability will be finally solved by the ingenuity of the inventor rather than by the adjudication of the courts. If the facts concerning electrolysis were scientifically determined and the possibility or impossibility of preventing its action at a reasonable cost settled by the engineer, the courts could readily apply their established principles to a determination of the conflicting rights involved.

Some light, however, may be thrown upon this question by the analogy of adjudicated cases bearing upon the relative rights of public service corporations to the use of the streets of cities and villages. The cases most directly in point are those which have arisen from controversies between corporations holding franchises for the use of streets for telephone service and those holding subsequent franchises for the use of the same streets for electric lighting and electric railways. The damages complained of by the telephone companies were those resulting from the disturbance of their currents through the leakage or induction of the heavier currents used by the other companies. While there is some conflict in these series of decisions, the general principle maintained is that although the rights of the telephone companies to the use of the streets may be prior to that of the other companies, still the earlier grant confers no exclusive privileges; that lighting, and especially transportation, are more distinctly the purposes for which the streets are held in trust for the people; that until it can be shown that the damages complained of are the result of negligence upon the part of the defendant corporation in not using practical appliances which can be put in at a reasonable cost, each company using the streets for the conduct of electricity is expected to protect itself against damages arising from a similar use of the streets by other corporations.

Water and gas companies may be said to stand upon a more favorable footing than telephone companies, as regards their rights to the use of the streets, to the extent that the service rendered by them is more necessary to the welfare of the community than that rendered by the telephone companies. On the other hand, it is clear that the causes of the injuries that they complain of through the action of electrolysis are far less determinate than in the case of the telephone

companies. Conditions of soil and climate enter into the problem to such an extent that it would be very difficult to establish in a court of law that the electric current was the direct and immediate cause of the damage. In a recent case in New York state (Siebrecht *v.* East River Gas Co., 47 N. Y. Supp. 262, decided in 1899), a gas company was held liable for damages done by escaping gas, due to the corroding of the pipes, either by the action of the salts of the earth or by electrolysis. It is quite evident that if water and gas companies are to be held liable for damages thus caused, they should in turn be given recourse against the companies by whose neglect their pipes have been corroded so as to make the injury possible.

Thus it can be seen that the difficulty in this matter is not so much with the courts as with the scientist and engineer. The difficulty of fixing the legal liability for damages of this nature will be solved as soon as it can be definitely shown that the use of the earth for a return current by a street railway company is the direct and necessary cause of the damages complained of, and that such damages could be prevented by the use of some practical appliance of reasonable cost. If such an appliance can be used by the railway company, then the duty of such companies to adopt it will doubtless be fixed, unless the water and gas companies by the use of a like expedient can prevent the injury to their property. Until science comes to the aid of the courts in this matter, however, it may be taken for granted that the courts will not attempt to usurp the field of the scientist and engineer and to fix a legal liability where a liability in fact can not be shown to exist.

On this subject, generally, I take this occasion to recommend a work that will prove of great value to the engineer as well as to the practicing lawyer, "The Law of Electric Wires in Streets and Highways," by Edward Q. Keasbey, of the New Jersey bar. The second edition of this work published this year will well repay the investment of any person interested in the subject under discussion.

LEGAL RIGHT OF WATER COMPANIES TO ENFORCE REGULATIONS.

When so stated in the rules and regulations on the blank applications of a water company that meter rental will be charged, can the payment of such rental be contested? If so, on what ground? Do you think that the courts in the case of suit would uphold the water company or the consumer? *Subscriber.*

The payment of water rental charges can be successfully contested in any case in which it can be shown that the service contracted for was not rendered, either by a failure of the company to supply water, or by such a contamination of the water supplied as to render it unfit for the use intended. In general, unless the municipality under legislative authority assumes responsibility for the correctness of the meter by requiring an examination and certification by one of its officers, the reading of the meter is not in itself a conclusive test that the service has been rendered, but may be proven to be incorrect by competent testimony. So, further, a water company may not discriminate between consumers in the matter either of rates or of supply. All persons are entitled to similar service at uniform rates and on equal terms. For a wrongful refusal or neglect to furnish water to an applicant, the person aggrieved may recover such dam-

ages as are directly traceable to the acts of the company. So, also, when the rates charged are in excess of the rates prescribed by law, or when the rates are clearly unreasonable, the consumer may contest the payment of the excessive charge.

Within these limitations a consumer who contracts with a water company for water to be paid for by meter rates must fulfill his part of the contract and make his payments according to the agreement. The company has the right to make such reasonable rules and regulations as to payment as may be needful. It may require a preliminary deposit as security and may shut off the supply for non-payment of rental charges. In the absence of a prohibitory statute it may provide that the charges for certain buildings shall be determined by meter rates, while other buildings of a different class shall pay by the month or year. Water companies are held to a high degree of liability for damages resulting from defective mains and negligent operation, and a corresponding right is given by the law to such corporations to pass all needful regulations to protect themselves from liability. Such regulations in all cases, however, must be just, reasonable and not discriminatory.

The courts will uphold the rights of the consumer or of the water company, as the circumstances of the case show the one or the other to be entitled to relief.

COMMENT ON CURRENT TOPICS.

Annual Meeting of the American Society of Municipal Improvements

At the time of going to press with this number the convention of the American Society of Municipal Improvements is in session. The meeting thus far has been one of the most successful the society has ever held. The preliminary program seemed to indicate too large a proportion of "seasons of refreshment," but its actual development does not show any diminution in the amount of good work usually expected of this society. The number of days is increased, and the informal mixture of business and pleasure, for which Milwaukee is so famous, makes the work more enjoyable. Most of the excursions had some object in view in the way of exhibit of public works or of manufacturing processes. An innovation which is worthy of notice and of imitation was the giving of an informal banquet on the first day of the convention under the patronage of the ladies of Milwaukee and those accompanying members of the society on the first day of the convention, thus putting one of the best means of forming acquaintances early enough in the session to be of immediate value.

The first day's session strongly emphasized the work of the society in promoting uniformity in municipal accounts and reports. This is encouraging.

When Mr. Herrmann proposed, three years ago, the consideration of this question, his was the only voice heard. The voice of the committee appointed to report upon

the subject was the only one heard at the convention in 1898. Some discussion of the subject followed a second report of the committee last year, and a committee was appointed to carry out one of the recommendations. This year we have the reports of the two committees and a paper by Mr. Baker, all strongly advocating uniformity in municipal reports, and recommending uniformity in municipal accounts, proposing joint committees of all the societies interested, and joint action of the census bureau, as great aids in producing such uniformity.

There is the usual list of papers on sewerage, paving and other subjects of interest to municipalities, bearing the usual marks of expert knowledge and care in preparation. Nearly all of these papers are presented in this number of MUNICIPAL ENGINEERING.

An important amendment to the constitution makes all working in the lines of municipal improvement eligible to membership, thus greatly increasing the number of persons who can be interested in the working out of the important problems under discussion.

Central Station Hot-Water Heating. As Mr. Yaryan describes central station heating by hot water the system is easily applied and operated, and the electricity developed by the engine whose exhaust steam is used to heat the water may be considered as the by-product, since it is not so constant in its work nor so easily measured. He states that in one plant described the amount of coal used averages twenty-five tons for each residence heated, and that individual plants would probably not average more than eighteen tons a year. The difference is accounted for largely by loss in ground radiation, which he estimates to be about 17 per cent. The removal of the dirt and trouble from the house, and the concentration of the smoke nuisance in a single chimney, where it can be partially abated, are worth a large part of this increase in cost, and there is a further saving in help employed to take care of furnaces, stow away coal, remove ashes, repair furnaces, as well as in deterioration of the heating apparatus of the houses. Much of the remaining 22 per cent. increase in cost of coal is accounted for by the fact that the heat is more uniform from the central plant, houses are kept warmer, and are kept fully warm at all times, there being no vexatious drops in temperature during the night or when the furnace boy fails in his duty. The full 39 per cent. increase in cost of coal is hardly accounted for by the two items mentioned.

There must be some additional explanations offered to prevent a charge of poor management at the station, or else the electric light can not be considered entirely as a by-product. Perhaps the increase in consumption of coal is exaggerated, that Mr. Yaryan may not be accused of making too good a case

for the system. In a paper before the American Society of Mechanical Engineers he gives ingenious designs for insulating box surrounding pipe and for grease separator for exhaust steam.

An interesting statement is that wrought iron pipe is not corroded by the hot water, while steel pipe is so affected until the metal is protected by a coating of residual carbon. Wrought iron pipes are therefore recommended. A series of experiments on loss of head by friction indicates a decrease in such loss with an increase in temperature. Thus with ten pounds pressure the discharge at the end of 450 feet of 1-inch pipe is increased about 25 per cent. at 212° over that at temperatures below 60°.

That the electricity can not be considered altogether a by-product is evidenced by the fact that it is now proposed to install a refrigerating plant and distribute cold brine in summer, through different pipes, of course, to utilize the exhaust steam which now goes to waste in the summer months.

Water Purification Experiments at Washington

The engineer in charge of the Washington aqueduct has been conducting a series of experiments upon the purification of Potomac river water similar to those by Mr. Fuller upon Ohio river water at Louisville and Cincinnati. Owing to limitations of time and appropriations the experiments have not been so complete as in the earlier investigations, but the results of all taken together are increased in value by the new information obtained.

The river water carries much finely divided clay in suspension about half the time and provision for sedimentation in reservoirs is made and will be materially increased. As in other cases it is found that the water can not be made clear by any reasonable amount of simple sedimentation. The observations show here what was first shown in experiments at St. Louis under the New York State Board of Health, that in the process of sedimentation the bacteria disappear much more rapidly than the finely divided clay, and that there is no reduction in turbidity after about 3½ days of sedimentation. There is a "bacterial" improvement of the water, which is valuable, but no improvement in appearance. Experiments in slow sand filtration and in mechanical filtration of the settled water were made.

The engineers recommend mechanical filtration, the cost of constructing a plant for slow sand filtration being nearly a million and a half greater than that of a mechanical filtration plant, though the annual cost of operating the latter is 26 cents greater per million gallons filtered. The results for removal of bacteria are somewhat more satisfactory for the mechanical method. The turbidity is materially reduced by that method, the number of days when the turbidity is greater than an as-

sumed standard being about half that resulting from slow sand filtration. The standard set is very high, and will result in satisfactory appearance of water practically every day in the year.

The estimates of cost are interesting, but the high price of land quoted places the totals out of the reach of comparison with the cost of similar plants in other cities. The details of cost of operation, as well as the general plans for filtration works, follow very closely existing models, and should be quite reliable, the conditions not being materially different from those in several other localities.

Illinois River Pollution. The first reports upon the effect of the pollution of Chicago sewage pumped into the Illinois and Michigan canal, upon the Illinois river and the process of self-purification of the river, were made by Dr. J. H. Rauch when secretary of the state board of health. Dr. J. H. Long was then, as now, the chemist of the board, and in one of the reports mentioned are given the results of a detailed examination of the action of the stream from the south branch of the Chicago river, from which it was pumped to Grafton on the Mississippi river. Under a resolution of the state board of health of July, 1899, Dr. Long made a similar investigation during the months of July–November, 1899, with a few results before and after at a few stations, all prior to the opening of the new Chicago drainage canal. This investigation is not quite so detailed as the former, the time devoted to it being shorter, but it includes points of interest not considered formerly, and in the light of the advancement of knowledge on this subject will be even more valuable. Samples of water were taken according to a regular plan at stations on the line of flow from Chicago city water and the Bridgeport pumping station to Grafton, and in addition a number of samples were taken in November and December from the tributaries of the Illinois river well up toward their sources, to show the natural quality of the drainage of the Illinois river basin.

The results of this investigation will be contained in the reports of the state board of health. Advance notes have been issued and are now obtainable. The investigation will be continued to show the effect of the drainage canal in improving the quality of the water in the river or the reverse. These results show a progressive improvement in the water, with a material addition of pollution at Peoria, which quickly disappears, the general form of the curve of improvement not being materially modified. The improvement is very rapid in the first 80 miles from Bridgeport to Ottawa, and is slight but recognizable from that point to the Mississippi river.

The advance notes also contain a short report from Civil Engineer J. A. Harman on the general appearance of the river water, the

conditions met with at different places and the sources of the water supplies of the cities and towns along the river.

Dr. J. A. Egan, the secretary of the state board of health, prefaces these two reports with a general statement of the work on the problem of improvement of Chicago's condition in respect to drainage and the investigations of its effect upon other communities, thus giving the connection of the present work with what has gone before.

Pollution of Running Streams by Sewage.

In an article in the August number of MUNICIPAL ENGINEERING, on "Pollution of Running Streams by Sewage," Mr. Tooke expresses the opinion that the statements in an article in this department, with a similar title, appearing in May, are directly in conflict with his opinions expressed in January and March. A careful rereading of the articles referred to leads the writer to say that he can not see the conflict of opinion. In fact, there seems to be a substantial agreement in all the principles upon which are based the rights of riparian owners where pollution of streams is concerned.

The difference between the New Jersey cases referred to and those in Indiana and other states rests in the fact that the New Jersey suits are for the restriction of the pollution of tidal rivers belonging to the public and subject to the direct control of the legislature, while the Indiana suits are for the restriction of the pollution of small streams whose beds are under private ownership, and in the use of which all such owners, and no others, have equal rights. The details of the treatment of the two classes of cases are different on this account, but the fundamental principles of justice underlying the right action of legislatures and the rights of both parties to the contracts made when legislatures authorize certain lines of action, must be upheld in all court decisions if they are to stand without reversal and serve as precedents for future action.

The decisions in such cases as those mentioned in Mr. Tooke's last article, and in another New Jersey case, probably still later (Attorney-General, *ex rel.* Henry P. Simmons *et al.*, *v.* The Mayor of Paterson), seem to be contrary to such principles of justice and such contract rights. The syllabus in this latter case states that:

(1) The city of Paterson had legislative authority to construct its system of sewers, discharging their contents into the Passaic river, and it is not therefore subject to the charge of maintaining a public nuisance.

This transfers the responsibility for the creation and maintenance of the public nuisance from the city of Paterson to the legislature. It does not abate the nuisance nor does it consider prior rights of other interested parties. This may be in strict legal form, but the removal of all control of such nuisances from the administrative and judicial branches and its concentration in the legislative branch of the government is

contrary to our established modes of procedure, and will often, as in this case, work manifest injustice. In the probable case of a legislature failing to take the necessary steps to abate the nuisance created by Paterson, there is no possible way of seeking relief except in the way of money damages, which may be not even a palliation.

(4) Jersey City has no rights in the waters of the Passaic river distinct from the rights of the general public, either by reason of the location of the water-works or in virtue of the act of 1852.

If the state legislature granted to Jersey City the right to procure water for the supply of its citizens from the Passaic river, it made a contract with that city which is equal in authority with that made with Paterson, and earlier in point of time. This paragraph might read "Paterson has no rights in the waters of the Passaic river distinct from the rights of the general public by reason of the construction of its sewer system." If one contract with the legislature is valid and subject to the construction this decision puts upon it, there does not seem to be any reason why the other contract is not equally valid and equally subject to the similar construction.

(5) By reason of the great injury which would fall upon the city by restraining the continuous use of its sewerage system, and the acquiescence of these riparian owners above where the tide flows, their injury being comparatively small, it would be inequitable to grant them an injunction.

In other words, a great wrong committed by the legislature through the city of Paterson must continue because it would cost more to correct it than the parties wronged would probably be able to collect at the end of a long and expensive suit for damages. Reference to the great expense which must be incurred by Jersey City in securing a new source of water supply on account of this grant to Paterson, and similar grants, expressed or implied, to other municipalities, is carefully avoided. Were it not ruled out by paragraph four there would be approximate equality in expense and justice would not be overshadowed by financial considerations. The following paragraph from the decision in amplification of paragraph four is of interest here:

At the time of the legislative grants to the city of Paterson in 1867, 1868 and 1871 it would have been competent for the legislature to pass a law prohibiting the further use of the Passaic water in Jersey City and compelling the city to procure its water elsewhere. Therefore the grant to Paterson must be regarded as a repeal by implication of the previous grant to Jersey City. If there was an impairment of that grant, which can not be conceded, Jersey City is without a standing to invoke the injunction power in this case.

This would give the legislature the power to destroy the value of hundreds of thousands of dollars' worth of Jersey City property without notice and without redress, and in the process to poison its citizens, their first notice of the new contract permitting Paterson to poison them, being received perhaps through the effects of the poison itself. Is it possible that the courts have no power in such cases to restrict the action of the

legislature, to prevent the consequences of its ignorance or knavery? It is quite within the bounds of possibility that a complaisant legislature should grant to some great private corporation a privilege along the tidal portion of the river which would drive all the inhabitants away from its banks, but under this decision they have no power to abate the nuisance. In addition to this paragraph (2) says:

(2) The title of the riparian owners along the Passaic river, where the tide ebbs and flows, extends only to high water. The state is the absolute owner of the bed of the stream. Such riparian owners, having no titles to the bed of the stream, are not entitled to an injunction against the city on account of the pollution of the stream.

There is nothing for such ripa rian owners to do but to abandon their property and flee for their lives. There is no way of abating the nuisance, and there seems to be no redress for injuries to property, and still less for injuries to health and business prospects.

Is there any loophole by which to escape from these conclusions, which it seems must be drawn from the statements made in this decision? A closer study of them warrants even stronger condemnation than that contained in our May article.

The case of Marcus Sayre *v.* The City of Newark, quoted on page 88, August, 1900, is similar in its rulings, saying:

The legislature of this state has constitutional power to confer on municipalities the right to use the tidal streams within our borders as outlets for public sewers, carrying off surplus waters and the sewage from buildings. The charter of the city of Newark grants to the municipal authorities of the city the right to use the Passaic river as such an outlet. The fact that such a use of the Passaic river pollutes the water and air in the neighborhood of a dock on the river owned by private persons, and thus lessens the value of private property, will not justify an injunction to restrain the city from constructing and operating a sewer which the municipal authorities have, within the limits of their legal discretion, determined to be necessary for sewerage purposes.

Unquestionably the legislature has such power over such streams, but have we no check upon the unjust exercise of such power by an ignorant or vicious legislature in overriding property and sanitary rights of equal validity, and in violating its own prior contracts of equal or higher standing?

Relation of Forests to Water Supply.

The effects of removing forests from new land upon the amount of rainfall, the rate of evaporation and the rate of discharge of the water in the streams draining the watershed have long been under discussion. So long as our data concerning rainfall and stream flow were insufficient, but partial conclusions could be drawn and fuller information has proven some of them wrong.

It was determined some years ago that the presence or absence of forests had little or no effect upon the amount of rainfall, though it may have some effect upon its time and manner of falling. Changes in the condition of the surface, due to cultivation and the breaking up of large areas of uniform character, such as prairies in their natural

state, seem to have the most marked effect upon the character of rainfall.

The question of rate of evaporation from forest or field is perhaps not yet settled, but the greater amount of more detailed information becoming available from year to year is furnishing a basis for more definite conclusions. Thus, studies of the forested and unforested areas of New Jersey by Mr. C. C. Vermeule, of the state surveys, led him to say, in 1895, that there was little or no difference in the rate of evaporation under the two conditions. Mr. Geo. W. Rafter, however, from his studies of the almost deforested Genesee Valley and the well-timbered watershed of the upper Hudson, drew the conclusion, in 1897, that the removal of forests made a difference in the rate of evaporation of about six inches in depth of water over the entire area per year. Mr. Vermeule points out that this calculation applied to the Croton watershed would increase the available supply for the city of New York 50 per cent. by increasing the amount of woodland from the 30 per cent. of the present day to 80 per cent. This seems hardly possible in the light of the data obtained from experiments on growing crops showing the comparatively small amounts of water required by them, and the less accurate observations indicating that forests require from two to three times as much water to supply their growth. The most superficial observation shows that evaporation from open water surfaces is much more rapid than from water surfaces protected from the direct sun and air by forests. The more rapid disappearance of water into the soil and into the streams in open country removes it more rapidly from the danger of evaporation, and thus offsets the greater rate of evaporation from the few open water surfaces remaining. Mr. Vermeule stated in a paper before the American Forestry Association in June that his study of 34 watersheds, mostly in the eastern United States, but a few in the west and in Europe, led him to the conclusion that the variation in forested area on these watersheds from nothing to 90 per cent. had practically no effect upon the rate of evaporation.

Observation of the conditions in forest areas, both in hilly and in flat countries, in cultivated areas and in desert areas, indicate clearly that a principal effect of forests is to delay the departure of the water into the soil and fill the streams. This makes the flow of springs more uniform and the floods in the streams less frequent, less heavy and less sudden. A cultivated soil, or one covered with vegetation, will delay the passage of the water to the streams, but not as well as a forested area. It facilitates the disappearance of the water in the soil and thus aids in keeping the springs uniform in flow. Where the depth of soil is great and the ground is nearly level (conditions of the prairies) subsoil drainage pre-

cedes cultivation and a new condition enters. Here the water reaches the stream more quickly and the suddenness, height and frequency of the floods is increased. The swamps being drained there is less water retained on and near the surface and the evaporation must be materially reduced. Planting of forests, judiciously located, will improve conditions by aiding in holding back the water from the streams and at the same time keeping the evaporation less than that from the primitive open swamps. There seems to be a tendency to increased frequency and diminished force of rain storms in districts where such forest areas have been planted. When more data for watersheds, prairie and partly forested, are available the actual facts can be shown.

Desert areas are open to the fullest effect of evaporation, but the rain storms are sudden and severe, and the surface of the ground has assumed forms which allow the water to run at once into the drainage channels, so that no water is retained in the soil, but little, under most conditions, percolates through to feed springs, and the floods in streams are therefore frequent, sudden and severe. As the edge of cultivation extends into the desert and the forests follow, conditions improve on the lines suggested and the deserts blossom, except in the few cases where there is no soil. Conditions similar to those of the desert develop in mountainous regions, like that of the upper Hudson, when the original forests are removed. The removal of the protecting limbs and roots allows the thin soil to be washed away and it is often impossible to renew any growth whatever on the clean rock surfaces remaining. The desert condition is produced without the possibility of future improvement.

The discussion of these points is of value to the engineer and the city official interested in water supply, because it suggests lines of possible improvement in the watershed from which his supply is drawn, whether his immediate source is surface water or a well. It will also indicate the necessity of controlling the change of conditions so that future deterioration in the watershed will not occur on account of bad management of the surface of the watershed.

Government Definition of Portland Cement.

The specifications for the construction of a lock at Plaquemine, La., require that the cement used in the work shall be "a high-grade American Portland." The contractor for the lock entered into contract with the Illinois Steel Company to furnish their "Steel Portland Cement" for the work. Some of this cement was delivered and used, but was afterward objected to on the ground that the cement in question was not a "high-grade Portland." A board consisting of Maj. Wm. L. Marshall, Maj. Wm. H. Bixby and Capt. Charles S. Riche, all of the Corps of Engineers, U. S. A., was

finally named by the Chief of Engineers to consider and report on the use of Steel Portland Cement in the lock. This board visited the works of the Illinois Steel Company, inspected several structures built with their cement in Illinois, and later examined the work done at Plaquemine and at Forts St. Philip and Jackson, where some of the cement in question had been used.

In its report the board, after citing several authorities, recommends the adoption by the department of the following definitions:

Portland cements are products obtained from the heating or calcining up to incipient fusion of intimate mixtures, either natural or artificial, of argillaceous with calcareous substances, the calcined product to contain at least 1 7 times as much of lime by weight as of the materials which give the lime its hydraulic properties, and to be finely pulverized after said calcination, and thereafter additions or substitutions, for the purpose only of regulating certain properties of technical importance, to be allowable to not exceeding 2 per cent. of the calcined product; otherwise additions or substitutions, after calcination, are adulterations, necessitating a change of name.

Puzzolana cements are products obtained by intimately and mechanically mixing, without subsequent calcination, powdered hydrates of lime with natural or artificial materials, which generally do not harden under water when alone, but do so when mixed with hydrates of lime (such materials being puzzolana, santorin earth, trass obtained from volcanic tufa, furnace slag, burnt clay, etc.), the mixed product being ground to extreme fineness.

In referring to the use of the "Steel Portland" in the lock at Plaquemine the report says: "This cement is a puzzolana slag cement of first-class quality and of exceptional purity and uniformity. Puzzolana cements possess many admirable qualities which make them specially useful in certain cases."

After saying that the removal of the concrete already laid is not considered necessary the report continues:

The board does not know of any failure as yet of the Illinois Steel Company's cement concrete where used in massive structures, but the use of any unproved cement in the Plaquemine lock seems too venturesome to be recommended for a work of such magnitude and cost. In this connection it is to be especially borne in mind that European Portland cements have been manufactured and used with excellent success for over fifty years; that American Portlands have also been manufactured and used with excellent success for about twenty-five years, while European slag cements have been made for about thirty years with but poor success and American slag cements have been practically unknown until within about five years. Under such circumstances the American slag cements, of which the Illinois Steel Company's cement is apparently the best up to date, have not yet had time to show their ability to stand indefinitely without disintegration or deterioration.

In conclusion the board repeats that the cement manufactured and sold by the Illinois Steel Company under the name of "Steel Portland Cement" should be classified under the generic name of puzzolana cement and under the specific name of slag cement and can not be classified as a Portland cement.

The Steel Portland cement, therefore, should not be accepted as a high grade American Portland within the meaning of the specifications of February 16, 1898, for the construction of the Plaquemine lock, and, irrespective of the specifications, its use in such lock seems too venturesome to be recommended for a work of such magnitude and cost.

As the report is accompanied by many appendices bearing on the manufacture and use of slag cement it forms a valuable resume of the subject. In one appendix is given a letter from Mr. Jasper Whiting, manager cement department, to Mr. E. J. Buffington, president Illinois Steel Company, describing the process of manufacture of their cement, and from this we quote as follows:

The process of manufacturing Steel Portland cement may briefly be stated as follows:

Slag of the proper composition is made to flow from the furnace in which it is produced through an open trough to the

chilling tank, where a large stream of cold water under high pressure is directed against it at right angles to its flow. Contact between the slag and cold water not only causes the slag to break up and disintegrate, but eliminates about one-third of its sulphur, and changes it chemically in such a way as to render it suitable for the manufacture of cement.

This chilling operation is a highly important factor in the process, and great care is taken to control the stream of slag and the flow of water in such a way as to make the chilling complete and uniform. After each lot of slag is chilled, a sample of it is taken and examined, both chemically and physically, in the company's laboratory. If the results of this examination are satisfactory, the slag is conveyed by means of cars to the cement plant, where another sample of it is taken and mixed with a definite proportion of prepared lime, and the whole ground in a miniature mill, where actual cement is produced. This trial cement is then submitted to physical and chemical tests to prove beyond a doubt that the raw materials and mixtures are correct. This test, reproducing as it does the actual conditions of manufacture, eliminates all experimental error and gives an accurate knowledge of what the finished cement will be. It is a precaution not taken, so far as we know, by the manufacturers of any other cement.

The preliminary examination of the raw materials being complete, the slag is then passed through a drier of special design and conveyed by an elevator into bins located over grinding mills of the Griffin type, which are used for preliminary pulverization. It is then conveyed by means of another elevator into bins over grinding machines of the tube mill type, where it is mixed with the proper proportions of prepared lime, as previously determined, and the two materials ground and intimately mixed together in the above mentioned tube-mills. The resulting powder, which is so fine that not over 4 per cent. is left on a 200-mesh sieve, is then conveyed by means of screws and elevators into large bins, from which it is drawn and packed into barrels and bags for the market.

An important factor in the manufacture of cement is the prepared lime. This lime, which is obtained from the calcination of Marblehead limestone or Bedford stone (as pure as exist in the country), is unloaded into bins, beneath which are placed two screens of different mesh, the coarse at the top. A quantity of lime is drawn on the top screen, where it is slacked by the addition of water containing in solution a small percentage of caustic soda. As the material is slacked it falls through the small screen onto the finer screen, after passing which it falls into a conveyor and is conveyed to a rotary drier. It would be perfectly possible to slack this lime and incorporate with it the desired quantity of caustic soda without any additional heat, but by so doing there is great danger of having particles of unslacked lime, which would render the resulting cement unfit for use. The wet and perfectly slacked lime, therefore, is conveyed into the afore-mentioned drier, and the final slacking done by the application of heat, so that every particle of lime is thoroughly slacked and the soda incorporated with it in the most perfect manner. The resulting prepared lime is then conveyed by means of elevators and screws into hoppers over the tube mills, where it is mixed with the ground slag in known but varying proportions.

Continual tests are made of the resulting products and every car that is shipped out is accompanied by a signed statement giving complete tests on contents.

It is only necessary to compare this process with that used in the manufacture of a true Portland cement to show the radical chemical difference in the two products. The one is calcined to the verge of vitrification after all the ingredients have been thoroughly mixed, while the other is simply a mixture of slacked lime and puzzolanic material ground to an extreme fineness. The possible limits of ingredients of Portland cement are quite well defined, while slag cements have a considerable range. The specific gravity of Portland is from 3.05 to 3.25, and should not fall below 3.10 in a fresh product, while slag cement has a specific gravity of 2.7 to 2.8. This difference in specific gravity furnishes one of the simplest tests for the detection of slag cement.

The rate of setting of Portland cement depends upon its chemical composition, degree of calcination, age and fineness.. The best Portlands are usually slow-setting, but

additions of sulphate of lime are sometimes made to retard the setting, and such additions to the amount of 2 per cent. are allowed by the association of German cement-makers. Slag cements are naturally very slow-setting, and materials are added to hasten the set.

These differences would seem to be sufficient to show that slag cement can not be classed as a Portland. Slag cement can be manufactured more cheaply than Portland, and since it has high sand carrying power, and can be used with safety in certain kinds of work, this advantage should be sufficient, and the American manufacturers of slag cement should be content to make their reputation as the American Portland cement-makers have been obliged to do. There is probably no question that the facilities for making slag cement of good quality are better here than in Europe. It may, therefore, be expected that slag cements can demonstrate that they have a place to fill, and that they need not prove the failure here that some of them have in Europe.

CURRENT INFORMATION.

The Water Supply of New York.

The Merchants' Association of New York, which formed a committee about a year ago to investigate the subject of the present and future water supply of that city, has finished its report. The committee was divided into sub-committees, as follows: (1) engineering; (2) municipal finance and public policy, (3) fire protection and insurance. The investigation was conducted by thirty-three men representing the engineering, commercial and legal interests of the city. M. Bannin was chairman of the general committee on water supply; Horace E. Deming, chairman of the committee on municipal finance and public policy; Arthur J. Baldwin, chairman of the committee on legislation; John R. Van Wormer, chairman of the committee on fire protection and insurance. The report of the general committee cites that from Jan. 1, 1832, to Dec. 1, 1898, the city of New York, Manhattan and the Bronx made a capital investment of $86,359,562 for the Croton, Bronx and Byram supplies, including the distributing systems; that during the same period interest charges, maintenance and operation aggregated $66,544,245; for these sixty-seven years the gross earnings were $88,017,330, leaving net profits of $21,473,084. The approximate average cost of water (Manhattan and the Bronx) in 1898, delivered to consumers, was $29 per 1,000,000 gallons. The price under the proposed Ramapo contract was $70, delivered at the city limits, to which $10 should be added for distribution, making $80 per 1,000,000 by contract, against $29, actual cost to the city in 1898. Figures are then presented by the committee which show that the increased cost of water under the Ramapo contract, and the decrease in net revenue, as compared with an additional supply developed by the city, and entirely clear of debt, would, by the end of the Ramapo contract, leave New York $195,000,000 in debt. The specific objections to the Ramapo contract are summarized as follows:

1. The price is exorbitant.
2. The contract is ambiguous as to the pressure at which the water is delivered at the city limits.
3. The contract is ambiguous as to the respective duties and privileges of both contracting parties.
4. The city will not own the plant at the termination of the contract.
5. The effect of the contract will be to force the city hereafter always to purchase water from that company.
6. It will deprive the city of large profits from a water supply owned by the city, or force it to raise the price of water, which would be injurious to its industrial interests.

Moreover, the experience of other municipalities in the United States, as well as in other countries, shows an almost continuous tendency to substitute publicly owned water systems for private, a tendency so persistent and so universal, and of such constantly increasing force, that the wisdom, in the public interest, of the policy of municipal ownership and control of water supply, would seem established by abundant experience.

The final recommendations of the committee on water supply, including all the sub-committees, are as follows:

1. No contract whatever should be entered into with the Ramapo Water company.

2. The policy of supplying New York City with water by contract should be opposed by all lawful means.

3. The legislature should clothe New York City with power to acquire by condemnation any water rights needed for its public water supply, excepting water rights actually used by, or necessary for, the supply of any other city, town or village.

4. The constitutional requirement that the bonds issued by New York City for a water supply should be included in ascertaining whether the city can become indebted for other municipal purposes should be removed.

5. The Comptroller's quarterly and annual reports should contain a clear and business-like statement of the financial status of the city's investment in its water works.

6. A carefully devised system of detailed, accurate and easily understood public records and reports should be adopted by the Department of Water Supply.

7. The financing by the city of any addition to its water supply should include the application of the surplus of the revenues over expenditures to the redemption of bonds issued to establish the plant.

8. Immediate steps should be taken by the city of New York to acquire an additional supply of 250,000,000 gallons of water daily from the Adirondack mountain watershed by either of the systems proposed in this report.

9. Immediate steps should be taken by the city officials to prevent the waste of water.

The sub-committee on engineering was composed of the following gentlemen: T. C. Clark, R. Hering, E. P. North, H. S. Haines, D. McN. Stauffer, H G. Prout, E. E. Olcott, H. R. Towne, D. LeRoy Dresser and R. R. Bowker. The engineering committee was requested to investigate the present and future water supply of Greater New York, including the amount now used and likely to be required hereafter, and the available sources for an additional supply. The committee was authorized by the Merchants' Association to retain a number of eminent engineers, and the latter were empowered to engage engineering and clerical staffs. The various engineers and the subjects of their respective reports were as follows: J. J. R. Croes, "The History, Condition and Needs of the New York City Water Supply and Restriction of Waste of Water;" Libbeus Ward, "The Pumping Stations Connected with the Water Supply of New York;" Foster Crowell, "The Use and Waste of Water in New York City," and "An Auxiliary Salt-Water Supply for First Protection, Street Washing, Sewer Cleansing and Other Purposes;" James H. Fuertes, "The Sources of Water Supply Suitable for the Future Use of the City of New York;" George W. Rafter, "A Water Supply from the Adirondack Mountains for the City of New York." The engineering committee also had access to the manuscript of the report of James F. Freeman, on the same general subject, recently submitted to Bird S. Coler, Comptroller of New York City.

Under the head of "Present Water Supply and Waste," the engineering committee presents the following conclusions:

1. That the average daily consumption of water in all the boroughs of New York City in 1899 was 371,778,000 gallons, or an average daily consumption per capita of 103 gallons, which approximates to the lowest rate of consumption in any large American city.

2. That while the amount of waste is considerable, we do not see any present prospect that it will be materially reduced.

3. That an increased water supply will become a necessity within ten years or less, and examinations and surveys should be commenced immediately.

4. That a reduction of waste by the extension of the meter system can and should be effected.

5. That more exact means should be provided for measuring and recording the actual consumption of water in all the boroughs.

6. That the flow through the new Croton aqueduct should be increased by giving it a thorough cleaning.

7. That a better distribution should immediately be effected in the Bronx.

8. That the present supply from the Croton should be increased, by urging the completion of Cornell reservoir, by the use of flashboards on the dams whereby a large additional amount of water may be secured, and also by the construction of new reservoirs, if found economical.

9. That the present supply of Brooklyn should be increased and improved by building a 48-inch conduit from Millburn to Spring Creek to utilize the water now available; by the erection of additional pumps at Millburn; by filtering the water at Jameco and Springfield; by remodeling the high service at Mt. Pleasant; and by making some of the other extensions and repairs now planned by the water department.

10. That the pollution of the surface waters of the Croton, Bronx and Long Island supplies is such as to warrant a purification of these waters by filtration as soon as this can reasonably be accomplished, this opinion having also been expressed by the Board of Health.

11. That aditional pumping machinery should be provided for the high service at Manhattan, and where required in other boroughs.

12. That if 10 per cent. of the waste within buildings in all the boroughs can be saved by metering (this saving amounting to about ten gallons daily per capita of the population of 3,608,000). this saving, together with the available increase of supply, referred to above, would probably enable the city to tide over a period not exceeding ten

years, which would barely suffice to make new sources of water supply available.

Of the 371,778,000 gallons of water supplied to the whole city daily in 1899, there was 23,399,000 gallons, or 6.3 per cent., furnished by private companies, all of the latter being pumped. Of the 348,379,000 gallons per day furnished by the city, 248,500,000 was delivered by gravity, but 44,000,000 gallons of it was subsequently pumped by consumers. Messrs. Croes, Freeman and Ward estimate the present daily consumption of water in the boroughs of Manhattan and Bronx at about 245,000,000 gallons, with an average yearly increase of 15,000,000 gallons. This territory is supplied by the Croton, the Bronx and Byram, the maximum capacity of which, with flashboards on all dams, is placed at 265,000,000 gallons a day until the Cornell dam is finished, and 290,000,000 gallons thereafter. With average rainfalls, and no reduction in per capita consumption, the supply would be in excess of the demand until 1903 was passed. The other boroughs have nearly or have reached the danger limit, but it is believed that the various measures therein recommended will tide over the supply for the whole city for perhaps ten years, or at least until an additional supply can be developed.

This report, coupled with the report of John R. Freeman, which appeared in the May number of Municipal Engineering Magazine, will, it is believed, bring New York City to a sense of realization of the danger of a water famine unless immediate steps are taken to provide a greater water supply for the rapidly increasing demand.

Water Supply of the National Capitol.

In his annual report to General Wilson, chief of engineers, in regard to the condition and needs of the water supply system of the District of Columbia, Col. A. M. Miller, corps of engineers, says that the present total storage capacity of all the reservoirs is a little less than 322,000,000 gallons, or about six days' normal supply. The total supply of water which the present conduit can safely furnish without a pressure dangerous to its safety is 76,000,000 gallons per diem. This, however, necessitates the lowering of the distributing reservoir to reference 144, thus involving a loss of head two feet at the point of distribution. Until the average daily consumption of water becomes considerably greater than at present the reference of the surface of the water at the lowest stage of the Potomac will be about 151 feet at the mouth of the feeder at Great Falls, about 146.75 at the Delecarlia reservoir, and 146 feet at the distributing reservoir. The report contains tables showing that the consumption and waste of water in the District of Columbia for June 27, 1900, was 50,897,227 gallons per diem, which is the largest June measurement ever taken. The United States census of 1900 gives the population of the District of Columbia as 278,712, which gives a daily per capita consumption and waste of 183 gallons. Investigation and measurements made in the various cities of the United States show clearly that a per capita daily consumption of 100 gallons is ample for all domestic business, and public purposes, and that any considerable increase above that amount must be attributed, says Col. Miller, to waste, due to the defective mains and service pipes, defective plumbing and willful waste. Col. Miller says: "This extravagant use of water has become a serious menace to the supply of water by the Washington aqueduct with its present capacity. The capacity of the aqueduct, with a head of 156 feet at the distributing reservoir, a head necessary to keep up the present pressure for the gravity supply, is 50,000,000 gallons per diem. If the level of the distributing reservoir was lowered to 155 feet, the ultimate safe limit of supply is 76,000,000 gallons. This latter involves a loss of head of two feet, so that to obtain the same pressure with the supply, additional pumping would be required. The present consumption and waste has also an important bearing on the subject of filtration. A report on the subject of filtering the water supply of Washington was called for by congress and submitted by this office March 28, 1900. It is probable that the cost of filtration will be about $6 per million gallons, or, at the present rate of consumption, about $300 per day, or $110,000 annually."

He suggests two remedies—either the reduction of consumption to a reasonable rate, 100 gallons per capita per diem, or the increase of the present supply to keep up with the present unreasonable and extravagant demand of 183 gallons per capita per diem. The first remedy, the reduction of consumption, can only be accomplished by the introduction of meters. The second remedy, the increase of the water supply to meet future demands at the present extravagant rate of consumption, involves the building of a second conduit from the Great Falls of the Potomac, with the necessary reservoirs, if any, and proper gatehouses and operating plant. In order that this subject may have proper consideration, with

due deliberation and provision, a survey of practicable routes is essential. These surveys should be taken in hand at once, says the report, and an estimate of $8,000 for such surveys is submitted with the report.

A detailed description is given of the work of repairing the Washington aqueduct tunnel under the general project for increasing the water supply of the district. It is estimated that $170,673.14 will be required to complete the Howard University reservoir to place it in a condition to be available in connection with the tunnel for the new system of water supply. A further expenditure of $439,567.96 will be required to complete the tunnel and accessories. The necessary amount required July 1, 1900, to complete the tunnel and reservoir was $610,241.10. The amount available was $448,618.13, leaving a balance necessary to complete the work, including the Howard reservoir, of $162,222.97.

An act was approved June 6, 1900, appropriating $200,000 for establishing those portions of a filtration plant which are essential to the operation of either system of filtration adopted, including necessary land, grading, masonry and appurtenances.

Investigation of Electrolysis in Providence.

In conjunction with the water department of Providence, R. I., A. A. Knudson, Member American Institute Civil Engineers of New York City, has been investigating the subject of electrolysis. Some 150 potential tests were made, mostly to determine whether the water mains were acting as conductors for the Union Railway company. Evidence was found that current was passing through the mains, the voltage in one instance being as high as twenty-five. Some of the new high-service fire mains are located in a district where both high and low service mains are constantly positive. The readings have ranged from one to two volts, and while not high, Mr. Knudson says it is not a desirable condition, and that probably electrolysis is taking place. An excavation at one point failed to show it, however, on the outside of the pipe. On a twenty-four-inch water main, extending about three and one half feet below the tracks for two miles ranged from four to six volts. An excavation in sandy soil, scarcely damp, showed electrolytic pittings on the positive side of the joint. In searching for the high difference in potential along this line a rail joint was uncovered, which showed a small two-bolt fish plate, a space between rail ends and a copper bond. Mr. Knudson is of the opinion that the play at such joints as these breaks the wire where it is bonded in, thus accounting for the high difference in potential. Still higher differences in potential were found later on near a turnout, and excavations showed the copper bond broken at one end and corroded at the other. Excavation showed a cast-weld joint on another line to be very complete and rigid. Mr. Knudson states that in one foot of ordinary sized rail it is seldom that a difference should not exceed 0.1 volt; but in many of the rails tested, where joints were included, in a length of one foot, the difference was more than one volt, and in two instances it ran five and nine volts respectively. Excavations to the water mains were made at eleven points. In some cases, where the soil was damp, and the current flow in the mains excessive, electrolytic pittings were found. These pittings were not immediately serious, as could be seen, being, in all but one case, on the bell end of the pipe length where the metal is heaviest. The conditions may be worse at other places, however. The effect of marked electrolytic action was shown on a line of old pipe taken up some time ago, both at the inner and outer ring of the bell. Although immediate danger to the water mains can be controlled if the water department will take frequent volt meter readings, and the street railway company will take prompt action to reduce the danger, yet Mr. Knudson says there will be no assurance of safety so long as the single trolley is used, in which the rails form one side of the circuit and are in contact with the earth. He suggests that in the future all requests for extensions to street railway lines be referred to the city engineer for investigation as to their probable effect on water mains.

Female Sanitary Inspector in Australia.

The city council of Melbourne, Australia, decided recently to appoint a female sanitary inspector to assist the medical officers in the work of sanitary inspection of the city. The salary will be $500 a year, and the inspector will be provided with a bicycle.

Decision on Paving Assessments in Detroit.

Judge Swan, of the United States Circuit Court, granted a perpetual injunction to prevent the city of Detroit from collecting a forced paving assessment. The decision was rendered in the suit of R. A.

Parker against the city of Detroit. By consent of the attorneys in the case, Corporation Counsel Tarsney had some additions made to the record of the forced assessment case put before Judge Swan handed down his decision. These additions cited the fact that Mr. Parker was benefited by the laying of the pavement, made no objections to the paving while the work was in progress, and did not in any way try to prevent the work from being done. He says this situation was not presented in the Norwood-Baker case, on which Judge Swan based his decision. He says:

"When a man goes into a court of equity and asks relief it is a primary principle that he must do equity and have clean hands. Now the upper court may hold either that Mr. Parker can recover only the difference between the amount he benefits from the pavement and the amount of his paving assessment, or it may reverse the decision of the lower court on the ground that Parker's acquiescence in the matter while the paving was in progress estopped him from later asking for relief in a court of equity."

The city has appealed to the Supreme Court and an early decision is expected. According to Judge Swan's decision the law under which the assessments for forced or petition paving are levied is in conflict with the fourteenth amendment to the constitution, which provides that no person shall be deprived of his property without due process of law. The fact that the assessments are made on frontage and not on benefits, and that no opportunity for a hearing is given the property-owner assessed makes the law invalid.

If the decision stands the city will have to pay the street opening bonds outstanding, as they are guaranteed by the city, and every property-owner who has paid assessments under the law for forced or petition paving will have an action against the city to recover the amount of his assessment.

Reducing the Price of Electric Light.

The Light, Power and Railway company of Marshalltown, Ia., has filed a petition in the United States circuit court against the city of Marshalltown, Mayor Frank G. Pierce and the members of the city council. The petition alleges that the mayor and council have illegally attempted to pass an ordinance lowering the price of electric light to such an extent as to make it impossible to manufacture it and supply the consumers at any profit whatever. According to the original contract, which the attorneys of the company declare is still in force, the company was allowed to charge 2 cents per watt hour to all consumers who used less than 50,000 watt hours per month. The present ordinance cuts this in two and reduces other charges, such as the minimum rate, which has been reduced from 90 cents to 75 cents per month. The company claims that it is impossible to operate the plant and make any profit whatsoever at these latter rates. The annual expenses of operation are $13,844. This reduction would make the receipts only $14,150, which would only leave an annual profit of $271.

Test of the Front Foot Assessment Law in Iowa.

Suit has been instituted in the federal court to test the Iowa front foot street paving law. The suit is brought by Chas. F. Clark against Polk county, the city of Des Moines, John McKay, treasurer; John McQuiston, auditor, and Smith & Reid, tax sale purchasers. The plaintiff owned six lots on E. Grand-ave., near Thirtieth-ave. When the city paved the avenue, about ten years ago, he refused the costs which the city and council assessed against him. Upon the repeated refusal of the plaintiff to pay the assessment the lots were put up at tax sale, and Smith & Reid purchased them. The plaintiff alleges that he has offered to pay to Treasurer McKay the general taxes on the property, but that official refused to accept the money on the ground that the property had passed from the ownership of Clark for his failure to pay the paving assessments. Since April, 1900, the treasurer and auditor have determined, says the plaintiff, to give Smith & Reid a tax deed to the property. He asks for a permanent injunction against the county officials to prevent their turning the deed over to the purchasers; that all the special assessments against the property be canceled; that a temporary injunction be granted.

Unsuccessful Effort to Compel a City to Pay for Water.

Judge Hollenbeck rendered a decision recently in the case of the Wahoo Waterworks Co. vs. the City of Wahoo, Neb. The plaintiffs asked for a writ of mandamus to compel the mayor and council to levy a sufficient tax to pay the contract price for city water. The contract was made in 1899 and calls for $2,000 per year for the first ten years and $2,500 for the next ten years. The seven mill levy was made in accordance with an act of 1897 and plaintiff alleges that it ran short $2,900 the first ten years; that the act was never passed by

the legislature and is unconstitutional. Judge Hollenbeck refused to grant the writ.

Water Rates Upheld by Court.

A decision in favor of the Los Angeles City Water Company, in its suit against the city of Los Angeles, Cal., was handed down Aug. 13, by Judge Ross, of the United States circuit court. The company brought suit to have declared invalid an ordinance establishing the water rates passed by the council in February, 1900. The court decides that the only way the city can be free to cut the rates is by paying or tendering to the company the value of the improvements on the plant, as well as the amount asked for the same. Until it does so, or offers to do so, all of the covenants and provisions of the contract continue, including that prohibiting the city from establishing lower rates than those charged at the time of the execution of the contract.

Entitled to Damages for Pollution of a Stream.

The Virginia supreme court rendered a decision recently regarding the pollution of Virginia rivers by sewage. A dairyman had a large and profitable establishment until a reformatory school was built farther up on the river on which the dairy was situated. The stream was so polluted from this school that the business of the dairyman and the health of his family were injured, and the market value of his property reduced. The court held that he is entitled to damage for the injuries to health and property. ,

Street Cleaning in Washington.

The third annual report of Warner Stutle, superintendent of the street cleaning department, District of Columbia, for the fiscal year ending June 30, 1900, was submitted Aug. 20. The amount appropriated for all work, including salaries of employes, was $172,970.12, of which $145,000 was for sprinkling, sweeping and cleaning, $24,200 for salaries, $2,000 for snow and ice work, with an unexpended balance of $1,770.19 of the latter appropriation. The total amount appropriated has been expended. Regarding the hand system of cleaning, Mr. Stutle says:

"The hand system of cleaning streets was adopted in this city July 1, 1897, and has been continued with unqualified success up to the present time. Its tentative period, if, indeed, it was ever deemed an experiment, has passed; if it was ever on trial the verdict is in its favor.

"The daily area cleaned during the first year was 304,128 square yards at a contract rate of 32 cents per 1,000 square yards. During the first year of this contract, the life of which contract was two years, I gathered data from which I was enabled to show that the work could be better done and at less cost to the city by day labor without contract than if done by contract.

"The second year the daily hand cleaning schedule was increased from 394,125 to 702,640 square yards, of which 308,512 square yards was cleaned directly by the District at an average cost of 18 cents per 1,000 square yards, as against 32 cents per 1,000 square yards paid the contractor.

"A provision in the appropriation bill for the third year, or the fiscal year ended June 30, 1900, limited the rate to be paid under contract to 22 cents per 1,000 square yards, by which we were enabled to get a contract at 21¼ cents per 1,000 square yards. This reduction in the rate enabled us to extend the service, and the daily schedule was increased to 1,230,778 square yards, which was cleaned daily during the past fiscal year.

"A provision in the appropriation bill for the fiscal year ending June 30, 1901, further reduced the limit to be paid under contract to 20 cents per 1,000 square yards, giving the commissioners authority to do the work themselves in the event of failure to get a contract at 20 cents or less per 1,000 square yards.

"No bids were received for hand cleaning, and the work is being done by day labor, without contract, at a cost of 18 cents per 1,000 square yards. This reduction in the cost enabled us to further enlarge the daily schedule, and we are cleaning at the present time a daily area of 1,565,809 square yards.

"The number of men employed to clean this area is 201, or an average area per man of 7,740 square yards. Each man is assigned a certin section or block which he is required to keep clean from 7:30 a. m. to 4:30 p. m.

"The outfit provided each man is a bag-carrier and half a dozen bags, push broom, with scraper attachment, hand sprinkler, short-handle shovel and broom.

"After sweeping the entire surface in the morning, the area is constantly patroled during the day and the droppings gathered and placed in bags for removal to the dumps.

"Eight inspectors are employed on this class of work, each being assigned to a certain division. Their duties are to patrol their divisions and see that the work is done properly and make a daily report to the office.

Mr. Stutler makes a plea for municipal control as follows:

"The vital point of difference between contract work and that done by a municipality is that the former is performed with an eye to accruing profits, while the latter is prosecuted with no other object than the accomplishment of the best results possible for the money available.

"A principal advantage of municipal work over contract work is that the employes will be under direct control of the municipality, so that when any section of the city shall require special attention a sufficient force may be at once transferred to such section, with no contractor to consult, no danger of complaint of infringing upon his

rights, and no troublesome contentions as to compensation for extra work. Another point in favor of municipal control is that but one set of employes will be under supervision, with no clauses of contract to be interpreted in cases where the work may be slighted; the work of supervision may be brought within smaller compass, and inferior work may be reduced to a minimum, because largely of the absence of motive to do inferior work or to wholly neglect any part of it. Under municipal control there will be no conflicting interests. The principal efforts should then be to ensure the best work possible at the least expense consistent with justice to the labor employed. If an employe then neglects the duties assigned to him the remedy may be applied direct and at once.

The six schedules for machine sweeping for the fiscal year ended June 30, 1900, averaged about 730,000 sq. yds. a day. The force employed by the contractor to clean this area daily is as follows: Ten sweeping machines with drivers, three sprinklers with drivers, sixteen carts with drivers, and eighteen broom and hoe men. Four inspectors are employed on this class of work. The lowest bid for machine sweeping for the current year was 18 cts. per 1,000 sq. yds., provided the contract was entered into for three years. The work of cleaning the improved alleys was done under contract at 33 cts. per 1,000 sq. yds. For cleaning unimproved streets and alleys the contract rate was $66.50 per day for furnishing 36 laborers, 12 horses and carts with drivers and all tools necessary to do the work, with provision to furnish extra laborers and horses and carts with drivers at $1.35 and $1.75, respectively, when ordered by the commissioners. Attention is called to the need of a larger appropriation for sprinkling unimproved streets. For sprinkling, sweeping and cleaning streets, avenues, alleys and suburban streets, including necessary incidental expenses, an appropriation of $169,400 is recommended, an increase of $14,400 over last year. For the collection and disposal of city refuse an appropriation of $106,579 is recommended.

Inland Lakes Can Be Legally Used for Water Supply.

A decision was rendered by Judge Clark of the United States circuit court, Aug. 17, refusing the petition of the Raymond Brewing company to prevent the city of Canton, O., from taking water from Meyer's lake. The Raymond Brewing company of Wheeling, W. Va., owns considerable land around Meyer's lake and has made a summer resort of it. The city of Canton decided to obtain its water supply from the lake, and accordingly condemned sufficient land to lay the pipes and erect the necessary pumping station. The Raymond Brewing company complained that if the city used the water it would lower the lake and destroy the pleasure resort. Judge Clark held that the city had a right to condemn land for this purpose.

Population of American Cities.

An official statement of the Census Bureau regarding cities whose official returns have been tabulated, shows the increase in the last ten years, as follows:

Cities.	1890.	1900.	Inc.	Pct.
Allegheny, Pa..	105,278	128,896	24,609	23.37
Baltimore	434,349	508,957	74,518	17.15
Boston	448,477	560,892	111,415	25.07
Buffalo	255,664	352,219	96,555	37.77
Chicago 1,099,850		1,698,575	598,725	54.44
Cincinnati	296,908	325,902	28,994	9.77
Cleveland	261,353	381,763	120,415	46.07
Columbus, O ..	88,150	125,560	37,410	42.44
Denver	106,713	133,859	27,14	25.44
Hoboken	43,648	59,344	15,716	36.01
Indianapolis ...	105,436	169,164	63,729	60.44
Jersey City	163,003	206,443	43.430	26.64
Kan. City, K's.	38,316	51,418	13,102	34.19
Kan. City, Mo.	132,716	163,752	31,036	23.37
Louisville	161,129	204,731	43,602	27.06
Milwaukee	204.468	285,315	80,847	39.54
Minneapolis ...	164,738	202,718	37,980	23.05
Newark, N. J..	181,830	246,070	64,240	35.33
New Orleans ..	242,039	287,104	45,065	18.62
*New York		3,437,202	.....	37.09
**Omaha	140.452	102,555	.....	.....
Philadelphia ...1,046,964		1,293,697	246,733	23.57
Pittsburg	238,617	321,616	82,999	34.78
Providence, R.I	132,146	175,597	43,451	32.88
Rochester, N.Y	133.896	162.435	28,539	21.31
San Francisco..	298,997	342,782	43,785	14.64
St. Louis	451,770	575,235	123,468	27.33
St. Paul	133,156	163,632	30,476	22.89
Toledo	81,434	131,822	50,383	61.88
***Washington.	230.390	278,718	48,326	20.98

*The increase of New York is estimated. No fair comparison with 1890 can be made, because the greater city now takes in several counties.

**Omaha shows a decrease of 37,897, or 26.98 per cent.

***District of Columbia.

As far as reported, Toledo, O., shows the greatest increase, 61.88 per cent., while Indianapolis stands second, showing an increase of 60.44 per cent.

Cleaning the Filters at Lawrence, Mass.

The report on the operations at the water filter at Lawrence, Mass., during 1899, states that the twenty-five beds were scraped twice each during April, July, November and December, and some of them three times. During January, February and March all of them missed scraping during one month out of the three, but during the remainder of the year they received attention every month. At the beginning of the year 600 yards of washed sand were on hand

and 3,102 yards more were washed during this period; 3,234 yards were used in 1899. The water required for washing amounted to 960,800 cubic feet, and the amount of sand put on each of the beds ranged in depth from 9¼ to 25¾ inches. The cost of operation and maintenance was $9,576.97.

Municipal Architecture in England.

A resolution was adopted recently at a meeting of the Royal Institute of British Architects providing for the design of municipal buildings in Great Britain by local engineers or surveyors. The resolution is as follows: "That in the interests of architecture it is inexpedient that important buildings of a municipal character be designed and erected by engineers and surveyors having no architectural training."

Cost of Cleaning Asphalt in Minneapolis.

City Engineer Sublette of Minneapolis says the cost of cleaning asphalt pavements during 1899 was as follows: Cleaning, machine sweeping and washing, 1.45 cents a square yard; total, 7.19 cents. During the season 199,978 square yards were cleaned by hand by the block system. The sweepings were put into galvanized iron cans at street corners, from which they were collected by teams. Employed in the work were five teams at $3 and $3.50 a day, and thirty-one men at $1 to $1.75 a day.

Defective Gravel Road Bonds.

The recent repudiation of $60,000 worth of gravel road bonds, at Greencastle, Ind., has brought out the fact that there is room for similar trouble in nearly every instance where road bonds have been sold, owing to a misunderstanding of the law on the subject of advertising the bonds. Campbell, Wild & Co., of Indianapolis, discovered, after the bonds had been delivered, that they had not been advertised as long as the law required, and that they were, therefore, worthless. The bonds were returned to the county, and the forfeit money, amounting to more than $600, was returned to Campbell, Wild & Co. This firm has been compelled to decline nine issues of bonds in Cass, Gibson, Morgan, Laporte and Putnam counties.

A Progressive Ohio Village.

The village of Collinwood, O., located on Lake Erie, about three miles east of Cleveland, has about completed its new electric light plant. The water works and electric light trustees are John M. Hart, R. C. Shepard and P. S. Westropp. The credit of bringing about the progressive work in Collinwood belongs largely to Mr. A. J. Thieman, who for four years has urged the improvement idea upon the residents of the place. Discouraging obstacles had to be overcome, including the reorganization of the entire village government. Extensive improvement plans are, however, now well under way, and it is expected that within the next thirty days they will have a water supply from the city of Cleveland. The village pays for this 80 cents per 1,000 cubic feet rather than assume the expense of going into Lake Erie for it, the Cleveland supply being much better than they could hope to procure independently. The new lighting plant will cost about $28,000, the contract for which was awarded to the Chase Construction company of Detroit.

Technical Meetings.

The convention of the Edison Illuminating companies will be held at Saratoga, N. Y., Sept. 4, 5 and 6.

The third annual convention of the Central States Water Works Association will be held at Columbus, O., Sept. 4, 5 and 6. C. W. Miles, Delaware, O., president; John Fisher, Hamilton, O., secretary.

The sixth annual convention of the Ohio Electric Light Association was held at Toledo, O., Aug. 14, 15 and 16. Some of the papers presented were as follows: "Transformers," J. E. Peck; "Station Management," J. H. Perkins, Youngstown, O.; "Two Revenues Instead of One," and "Electricity as a Bi-Product," A. J. Stahl, La Porte, Ind.; "Induction Integrating Watt Meters," E. J. King, Ft. Wayne, Ind.; "Choice of Periodicity of Alternating Current Apparatus," Capt. Jas. H. Andrews, of the General Electric Co.; "The Desirability of Using Storage Batteries in Medium-Sized Stations," L. G. White, of the Columbus Edison Co.; "Arc Lighting," H. W. Hilman.

The annual convention of the Canadian Electrical Association was held at Kingston, Ont., Aug. 29, 30, and 31. The convention was to have been held at Ottawa, but owing to the recent fire this was not convenient. The program, while not complete, contained the following papers:

"Utilizing the Available Central Station Capacity," Prof. R. B. Owens, McGill University, Montreal.

"Use of Dynamo and Storage Battery in Telegraph Offices," W. J. Camp, C. P. R. Telegraph office, Montreal.

"Power Factor as Affecting Operation and Investment, with Special Reference to Induction Motors and Enclosed Arc Lamps," F. H. Leonard, jr., Montreal.

"Government Electrical Standards," O. Higman, Ottawa.

"Railway Subject, Giving several Curves showing the Average Power during a Day, and Maximum and Minimum Requirements for Power called for on the Quebec System," Mr. Blair, Quebec Railway and Lighting Co., Quebec.

"Rotary Converters," A. Gordon Grier and J. C. Hyde, Montreal.

"Conditions Affecting the Wave Form of Alternators," Prof. L. A. Herdt, McGill University, Montreal, Quebec.

A good roads convention was held at Saginaw, Mich., Aug. 21 and 22.

The International Acetylene Association held its regular meeting in Chicago Aug. 28 to 30. J. B. Carroll, secy.

A State Good Roads congress will be held at Topeka, Kas., Sept. 25 to 28. Addresses will be delivered by the Hon. James Wilson, secretary of agriculture; the Hon. Charles Emory Smith, postmaster-general; the Hon. Martin Dodge, director of the office of public road inquiry. A macadam road will be laid, during the meeting, from the city limits at Washburn college to Seabrook, 1½ miles, under the personal supervision of George E. G. Harrison, government road expert, of Asbury Park, N. J. F. J. Anderson, Secy., Topeka.

The third annual field day of the Connecticut Valley Highway Association was held at Easthampton Aug. 15. The next meeting will be held at Westfield, Mass.

The American section of the International Association for testing materials will hold its annual meeting at New York City, Oct. 25 to 27. Richard L. Humphrey, City Hall, Philadelphia, secretary.

The annual meeting of the American Gas Light Association will be held Oct. 17 to 19, at Denver, Colo. Alfred E. Forstall, 58 William-st., New York City, secretary.

The fifth annual convention of the National Association of Municipal Electricians will be held at Pittsburg, Sept. 25 to 27. Papers will be read and discussed as follows: "Benefits to be Derived from Our Association," by William Brophy; "Contact Points," by Frank C. Mason; "Trials and Troubles of Instituting and Employing Municipal Inspection and Control," by M. G. Canfield; "Automatic Fire Alarm Systems," by Charles Burger; "Advantages and Disadvantages of Carrying High and Low Potential Conductors Upon the Same Poles," George H. F. Cottell, City Electrician, Boston, Mass., secretary.

The National Municipal league will hold its next annual meeting at Milwaukee Sept. 19, 20 and 21. Two sessions will be held each day, at which subjects of importance will be discussed and interesting papers read.

Municipal Reports.

Thirteenth Annual Report of the Board of Directors of the Street and Water Department of Wilmington, Del. Harvey J. Wiley, Secretary.

The city authorities of Wilmington have been seriously hampered in their plans for improvement by the failure of the legislature to pass a bill as expected authorizing the council to provide necessary funds. There has, in consequence, been general complaint. A street cleaning force, comprising fifteen barrow patrolmen and five patrol hand carts, with twenty workmen, have cleaned about twenty miles of streets per day. After observing the work of street cleaning in other cities, Mr. Wiley states that it has been noted that the maximum amount of labor with a greater degree of efficiency is secured to the city from the practice of uniforming the patrol cleaning corps, the uniform making the workman conspicuous as a public servant who would be readily recognized if derelict in his duty. A part of Mr. Wiley's report is devoted to valuable information obtained at the annual meeting of the American Society of Municipal Improvements and expresses satisfaction with the results of Wilmington's connection with this organization.

Twenty-seventh Annual Report of the Board of Public Works of the City of Grand Rapids, Mich., for the fiscal year ending April 30, 1900. George R. Perry, mayor; George M. Ames, city engineer.

A special feature of the report is the information given regarding the new municipal electric lighting plant completed during the year at a cost of $186,253. The total cost of operating the plant 131 days was $8,197, which, with 470 lamps in the circuit, would amount to $48.55 per lamp per year. This includes the cost of fuel used in running in the day time for the purpose of testing and regulating the plant when in complete running order. There was an increase of revenues in the water works of about $32,313 over the previous year, due more to the adoption of improved methods in the keeping of accounts and making collections than to an increased number of consumers. A new system of bookkeeping was inaugurated, which resulted in the payment of rates more promptly and reducing the amount carried in delinquent bills. Further improvements are contemplated, having in view the purpose to place the department on a more systematic basis. The total income from water was $125,946, and the total expense, including interest charges on bonds, $87,915. It is the purpose to increase the number of meters as rapidly as possi-

ble, as the most practicable means of stopping waste. Meter consumption has also been found by many to be less expensive than the schedule rate. At the minimum meter rate the water pumped during the year should have produced a gross income of $204,400, and the Board of Public Works has arrived at the conclusion that before the department can be considered as permanently self-sustaining its income on the present basis must be increased to $186,653.

Annual Reports of the City of Nashville, Tenn., for the year 1899. William M. Leftwich, jr., City Engineer.

The report of the water works department shows collections amounting to $135,435, and the operating expenses, $67,334. During the year one and one-fourth miles of streets were paved with granite and brick, while 4,445 ft. of brick sewers and 16,237 ft. of pipe sewers were laid. About one-fourth of a mile of old stone sewers were replaced with brick and pipe.

Annual Report of the Water Board of Bangor, Me., for the year ending February 28, 1900. Walter I. Brown, clk.

As the charges to the city for water were reduced from $12,000 to $8,000 there was an increase in the year's earnings of only $321.51. The board expects the plant to be self-sustaining in the future.

Personal Notes.

Fairman Rogers, M. Am. Soc. C. E., of Philadelphia, Pa., died in Vienna Aug. 22.

C. E. Thomas has been appointed chief of the bureau of streets at San Francisco, Cal.

Charles Cobb has been appointed superintendent of the water company at Kankakee, Ill.

W. F. Miller has been appointed engineer in charge of the filtration work at Pittsburg, Pa.

W. E. Brush has been elected superintendent of the City Water Works, at Eufaula, Ala.

George Leighton has been appointed city engineer, to succeed Randolph Mason, at Carbondale, Pa.

Fred P. Spalding has been elected to the chair of Civil Engineering in the Missouri State University.

Edward F. Goff has been appointed a member of the board of water commissioners at Hartford, Conn.

Charles Sharp has been elected superintendent of water works and inspector of sewers at Manchester, Va.

Charles C. Moore has been elected to the chair of Civil Engineering at the University of Washington, at Seattle.

I. C. McConnell has resigned as instructor in civil engineering at Cornell university to take up private practice.

J. J. Coleman of St. Louis succeeds W. L. Hart, resigned, as general superintendent of the Washington Traction and Electric company.

A. S. Nye, Jun. Am. Assoc. C. E., has been appointed assistant engineer on the staff of the New York Croton aqueduct commission.

H. D. Baldwin has been appointed engineer and superintendent of water works at Shullsburg, Wis., to succeed Will Edwards, resigned.

Geoffrey Stead, C. E., of St. John, N. B., has been temporarily appointed assistant to E. T. P. Shewen, chief engineer of public works in New Brunswick.

W. J. Fay, C. E., and one of the principal owners of the Anaheim Union Water company, Anaheim, Cal., was recently shot and killed by train robbers in Colorado.

James D. Schuyler and A. H. Koebig have been retained as the city's experts in the action of the city of Los Angeles against the West Los Angeles Water company.

Profs. Arthur Newell Talbot, M. Am. Soc. C. E, and Ira Osborn Baker, M. Am. Soc. C. E, of the University of Illinois, are studying the sewerage and water works systems of Berlin, Germany.

Lyman E. Cooley, J. E. Mahoney and Charles L. Harrison have been retained by the Denver Union Water company, Denver, Col., for consultation regarding proposed extensive improvements.

Samuel Parsons, jr., of Parsons & Pentecost, New York City, has been retained by the war department as landscape architect for preparing a scheme of treatment for several portions of Washington.

John H. Esson, general contractor of Chicago, Ill., committed suicide by shooting himself, Aug. 27, at the Hotel Vendome, New York City, after dangerously wounding H. H. Stridiron, an associate.

H. A. Sprague has resigned his position, which he held four years, as superintendent of the lighting system at Portland, Mich. He has associated himself with parties who will operate and own the electric light plant in Corunna.

Edward P. North, vice-president Am. Soc. C. E., and W. F. Willoughby of the United States department of labor, are at Berlin, Germany, inquiring into the economic value of technically educated labor from the standpoint of the employers.

James P. Morrissey, city engineer at Dunkirk, N. Y., was tendered a reception recently by the city council and department officials in celebration of not only his birthday, but in recognition of his services in an official capacity.

C. F. Hewitt, Elmira, N. Y., has been appointed superintendent of the Home Electric Light and Power company of Elkhart, Ind., to succeed A. N. Barrow, who has been appointed general superintendent of the electric, gas, water and railway properties of a Chicago firm.

H. J. Burt has been appointed assistant professor of civil engineering, B. S. Lamphear assistant professor in electrical engineering, and I. A. Williams instructor in mining engineering by the trustees of the Iowa State Agricultural College at Ames, Ia.

E. S. Hyde has resigned his office as assistant city engineer of Dubuque, Ia., in order to give his entire time to private practice as senior partner of the firm of Hyde, Baumgartner & Geisheker, municipal engineers and surveyor of that city. Mr. Hyde has had ten years' service in the office just resigned.

MACHINERY AND TRADE.

Recent Inventions.

(Reported especially for MUNICIPAL ENGINEERING by Arthur M. Hood, Indianapolis, Ind. Copies of any patent may be obtained for ten cents.

No. 654,617, July 31, 1900.—Tamping Roller, John W. Fitzgerald, Kern, Cal. The roller is provided with radially movable tamping shoes.

No. 654,701, July 31, 1900.—Wagon Road Construction, Charles W. Baker, Mountclair, N. J., assnr. to Menard K. Bowen, Chicago, Ill. A metallic rail having a concave upper flange adapted to receive flangeless wheels.

No. 655,260, Aug. 7, 1900.—A machine for making and repairing roads, Ortus E. Moats, Harvey, Ill., assnr. to Frederick C. Austin, Chicago, Ill. A road scraper of peculiar metalic-frame construction and having the usual vertically adjustable scraper.

Nos. 655,320 and 655,321, Aug. 7, 1900.—Autotruck for Garbage, Ashes, etc., James C. Anderson, Highland Park, Ill. Self-propelling vehicles particularly adapted for gathering garbage.

No. 655,971, Aug. 14, 1900.—Street Sweeper, Cornelius C. Gardner, New York. The dirt is deposited by a rotary brush upon a transverse endless carrier which, in turn, deposits it upon a longitudinal endless carrier leading to the dirt box or platform upon which the dirt box may be set.

No. 565,975, Aug. 14, 1900.—Rubbish Crematory, James Hall, Buffalo, N. Y. A furnace arranged to burn combustible rubbish without the aid of other fuel.

Trade Publications.

Julian Scholl & Co., 126 Liberty-st., New York City, have issued illustrated catalogue No. 2 with price-lists for general contractors, road builders, street pavers and municipalities. It embraces all kinds of machinery and supplies of the kind indicated, and will be sent free upon application.

The annual booklet of the Barber Asphalt Paving company for 1900 has just been issued. In addition to many illustrations showing asphalt pavements in American cities it contains the usual statistical information, together with colored maps, showing the amount and location of the asphalt pavements in different cities laid by the Barber company. The booklet embraces 125 pages, and has a very attractive colored cover.

The Globe-Wernicke company of Cincinnati has issued a very attractively illustrated booklet on their elastic bookcases, showing how they can be adapted to all needs of a growing library at the least immediate expense. A copy will be sent on application.

The Carson Trench Machine company, Charleston, Boston, has issued the fourth edition of catalogue C concerning the Carson-Lidgerwood cableway for excavating and refilling all kinds of trenches. The catalogue is a description and illustration of cableways from the point of view of those who have used them and like them. It covers all points regarding their operation.

Trade Notes.

ASPHALT.

After Sept. 1 the New York office of the Alcatraz Paving company and the Alcatraz company will be on the twelfth floor of No. 11 Broadway.

The National Asphalt Company filed an amended certificate Aug. 16 with the secretary of state of New Jersey, increasing its capital stock from $15,000,000 to $22,000,000.

BRICK.

The establishment of a new paving brick plant is being promoted by Fred Roth.

The Kansas Vitrified Brick company, Chanute, Kan., has been granted a charter.

The vitrified brick works of Lewis, Thomas & Co., Royersford, Pa., were almost completely destroyed by fire recently.

The Kansas City Vitrified Brick company, Chanute, Kan., has been organized, with the following directors: G. L. Northrup, H. C. Yockey, J. C. Carpenter, A. B. Hedrich, J. B. Beatty and F. H. Huston.

The Sedalia Building and Brick Paving company, Sedalia, Mo., has begun the manufacture of brick. The officers are: President, Miss Maggie Winzenberg; secretary, A. W. Winzenberg; chairman board of directors, Edward Gurley.

CEMENT.

A cement plant is proposed at Marksboro, N. J.

The Sun Portland Cement company, Owen Sound, Ont., has been incorporated.

A bonus of $10,000 for a cement plant will be contributed by Lakefield, Ont., Canada.

The erection of a Portland cement plant in Marengo county, Alabama, is contemplated.

The Birmingham Cement company, whose plant at Ensley, Ala., was destroyed by fire July 10, will rebuild at once.

The erection of a new Portland cement plant is contemplated at Ithaca, N. Y., according to press reports.

A large plant is being erected for the Alsen's American Portland Cement Works, at West Camp, N. Y., by Lathbury & Spackman of Philadelphia.

The People's Asphalt company, Wilmington, Del., has been incorporated to manufacture and deal in asphalt and cement.

The establishment of a large cement plant at Holly, Mich., in the near future, is contemplated, according to press reports.

The Union Light and Heat Co., of Cincinnati, O., was chartered Aug. 21 at Dover, Del. The company will install gasworks for lighting towns.

The Nazareth Portland Cement company Nazaret, Pa., has sold its plant to a New York syndicate, which is represented by George Coffin Warner.

The new mill of the Reading Cement company, Evansville, Pa., is ready to begin operations. The office address of the company is 536 Penn-st., Reading, Pa.

Mansfield, O.—Sealed bids are asked until

Newly incorporated electric light companies: Middleburg and Schoharie Electric Light, Heat and Power Co., Middleburg, N. Y.; Citizens' Electric Light and Power Co., Sandusky, N. Y.

Sept. 10 for furnishing and delivering 3,000 barrels of American Portland cement, Robt. G. Hancock, Prest. sanitary bd. George A. Clugston, secy.

According to a report of the Belgian consul at Valparaiso, the imports of Portland cement into Chili average 100,000 barrels per year. Chili is one of the largest consumers of cement in South America.

The Atlas Artificial Stone company, Brooklyn, N. Y., has been incorporated to deal in cement, concrete, etc. The incorporators are Mary J Burke and W. Kniskern of Brooklyn and Mary A. Sproule of Yonkers.

The Zenith Portland Cement company which is said to have inexhaustible beds of marl at Grass Lake, near Jackson, Mich., has been incorporated. A plant will be built with machines, in Jackson.

The Wisconsin Traction, Light, Heat and Power Co., has been incorporated by capitalists of Milwaukee. The incorporators are: Henry C. Payne, John I. Beggs, Charles F. Pfister and Frank C. Bigelow. The main offices will be in Milwaukee.

Plans and specifications are being prepared by Robert F. Wentz, consulting engr., for the erection of a building for the Imperial Portland Cement company of Nazareth, Pa. The building will be erected on 300 acres of land which the company has purchased at Christian Spring.

The Egyptian Portland Cement company, Detroit, Mich., has been incorporated by J. D. Heddon and C. A. Wilson, of Holly; E. D. Kennedy and C. M. Topping, of Fenton; J. F. Williams, of Detroit. The office will be at Detroit and the works at Silver Lake and Holly.

The New York and Queens Electric Light and Power Co. has been incorporated to manufacture and use electricity for producing light, heat and power, and in lighting streets and buildings in Queens and Nassau counties. The directors are: Henry H. Wilson, New York City; Thomas W. Stephens, Harry L. Snyder, Montclair, N. J.

A Portland cement plant having a capacity of 1,000 barrels a day, is being designed for the Detroit Portland Cement company by Lathbury & Spackman of Philadelphia. The plant will be erected at Fenton, Mich., and will be equipped and operated exclusively with electricity, the various machines being directly connected to motors obtaining their current from a central power house.

The August number of Municipal Engineering Magazine stated that the Bronson Portland Cement company, Bronson, Mich., which closed last October for improvements, had begun operations again. This is incorrect in relation to the closing down of the plant, as it did not shut down until January, 1900, having run almost continuously for a year without a single shut down, and commenced manufacturing in June.

The Rockland Cement company, Newark, N. J., has been incorporated by James A. De Groat, of Jones Point; Samuel A. Ver Valen, Haverstraw; Cornelius J. Curtin, of Newark. The main office will be at 22 Clinton-st., Newark.

The Consolidated Kaolin & White Hydraulic Cement company, East Orange, N. J., has been incorporated by George W. Harris, Thomas Van Soan, George C. Stevens, Henry Seigman and Charles White.

MACHINERY.

Brainerd, Minn.--Bids are asked until Sept. 4 for furnishing a stone crusher and a road roller. The bids received Aug. 7 were rejected. Co. Audt.

Schillinger Bros. of Chicago, have made a proposition to the city of St. Joseph, Mo., for the purchase of an asphalt plant, which is being considered.

McKeesport, Pa.—The question of purchasing a sprinkler, a street sweeper and two wagons is being considered by the council. R. A. Hitchins, cy. compt.

The Charles Warner company, Wilmington, Del., has recently erected at its Cedar Hollow lime quarries a stone crushing plant of over 800 tons daily capacity. The company contemplates the publication of a booklet for advertising this material for road-making purposes.

MISCELLANEOUS.

The Dominion Paving company, Toronto, Canada, will erect a saw mill at Lindsay, Ont., to cut paving blocks.

Nikola Tesla has been granted a patent for an invention which will prevent the escape of electricity from a wire. It is claimed that this invention solves the insulation problem in a simple manner.

The organization of a stock company at Rockwell City, Ia., for the purpose of putting in a central heating plant is being considered by a number of capitalists of that city.

SEWER PIPE.

The Nonesuch Fire Clay company of Empire, O., contemplates adding a sewer pipe plant to its works.

Newly-incorporated water companies: Gold Mountain Water company, Sonora, Cal.; Fig Four Water company, Whittier, Cal.; Paulton Water company, Wilkinsburg, Pa.; Allegheny Township Water company, Wilkinsburg, Pa.; City Water company, Shelbyville, Ill.

The United States Clay Manufacturing company has issued a circular in which they say: "Our attention, for some time past, has been repeatedly called by responsible parties to a statement (having its origin with competitors of ours) that the works now owned and operated by this corporation for the manufacture of vitrified salt-glazed sewer pipe, have been absorbed by a later company or passed from under our control. We take this opportunity to announce that no sale of the plants owned by this company, for the manufacture of sewer pipe, has been under consideration or is contemplated, and that we shall continue offering, in the different markets, products of superior quality, under our own corporate name."

WATER.

The New York Filter Mfg. company, 15 Broad-st., New York City, has closed a contract with Joseph Westcott & Son to build a filtration plant of 3,000,000 gals. daily capacity at Rensselaer, N. Y., for the East Albany Water company.

Newly incorporated water companies: Yellow Creek Water Power company, Bedford, N. Y.; Citrus Belt Water company, Glendova, Cal.; Pioneer Water company, No. 2, Price, Utah; Lee Water Supply company, Lee, Ill.; Cass Water, Light and Power company, Cass Lake, Minn.; North End Water company, Colton, Cal.; United Water Works Improvement company, Camden, N. J.

IMPROVEMENT AND CONTRACTING NEWS.

PAVING.

Newark, N. J.—City Surveyor Adam visited Toronto and Hamilton, Canada, recently, to investigate the methods used in laying tar macadam pavements. Part of Sussex-ave. will be paved with that material.

Grand Rapids, Mich.—Judge Newnham of the superior court denied the application of David A. Crow for a permanent injunction to prevent the execution of the contract between the city and the Luten Engineering and Construction company for the paving of Sheldon-st. with asphalt blocks.

CONTEMPLATED WORK.

Elizabeth, N. J.—N. Broad-st. will be paved with asphalt.

Peoria, Ill.—Asphalt paving is contemplated for Arcadia-ave.

Wausau, Wis.—Grand-ave. and Forest-ave. will be macadamized.

Rushville, Ind.—A number of alleys will be paved with brick.

Orange, N. J.—Mayor Stetson is urging the paving of Main-st. with asphalt.

Freeport, Ill.—North and South Galena and Lincoln-aves. will be improved.

Belvidere, Ill.—The question of asphalt or brick paving is being agitated.

West Union, Ia.—Elm-st., from Vine to Arlington corner, will be macadamized.

Elmira, N. Y.—The paving of Market-st. with vitrified brick is contemplated.

Rochester, Mich.—This town has voted to issue $6,000 street improvement bonds.

Titusville, Pa.—This town voted to issue $6,000 in bonds for paving Spring-st.

Montreal Quebec.—The property-owners on McGill-st. have petitioned for asphalt paving.

St. Augustine, Fla.—Brick paving is contemplated for Cathedral-place and Hypolita-st.

Racine, Wis.—The estimated cost of the proposed brick paving on N. Main-st. is $48,864.

Syracuse, N. Y.—Liberty and S. Warren-sts. will be paved with asphalt. E. F. Allen, cy. treas.

Marion, Ia.—Macadam paving is proposed for Seventh-st., from Fourteenth to Nineteenth-st.

Winnipeg, Man.—Coulton-st., from Qu'Appelle-st. to Cumberland, will be paved with asphalt.

Tampa, Fla.—The question of issuing $300,000 bonds for paving the county roads will be voted on Sept. 18.

Montgomery, Ala.—An ordinance has been passed providing for the paving of sidewalks on S. McDonough-st.

Annapolis, Md.—The city council has decided to pave West-st. with vitrified brick at a cost of $25,000.

East Orange, N. J.—An ordinance for macadamizing, grading and curbing Girard-ave., was passed Aug. 27.

East Pittsburg, Pa.—The question of issuing $55,000 bonds for public improvements will be voted on Sept. 11.

Iowa City, Ia.—The council has ordered that Dubuque-st., from College to Burlington, be paved with brick.

New Britain, Conn.—The superintendent of streets has been authorized to macadamize N. Stanley and E. Main-sts.

Lancaster, O.—The bids for paving High-st. were rejected and new bids authorized. John N. Wolfe, cy. engr.

Findlay, O.—A resolution has been passed to macadamize West-st., from Washington to Lincoln. Frank C. Ray, cy. clk.

Joliet, Ill.—An ordinance has been passed for paving Cass-st. with brick and curbing, at an estimated cost of $7,668.25.

St. James, Minn.—The council has condemned about 11,000 ft. of sidewalks and ordered it replaced with cement or stone.

Albany, N. Y.—Swan-st. will be paved with brick on gravel foundation. Park-ave. and Plain-st. will be paved with bricks.

Chicago, Ill.—Bids will be asked for paving parts of Wabash-ave., State, Clark and Twenty-second-sts. and Archer-ave.

Sioux City, Ia.—Bids have been authorized for macadamizing Jackson and Pierce-sts., between Second and Third. Mayor Burton.

Menominee, Mich.—The county commissioners contemplate rebuilding and macadamizing the old bay shore road to Cedar river, 32 mls.

Beaumont, Tex.—The question of issuing $15,000 bonds for permanent street improvements and sewerage will be voted on Sept. 11.

Duluth, Minn.—Bids will be asked for repaving W. Michigan-st. with brick, granite, creosoted block or sandstone. Mayor Hugo.

Wilkinsburg, Pa.—The borough engineer has been authorized to advertise for bids for paving Mifflin, Cole, Wood, Meade and Mill-sts.

Lincoln, Neb.—The city council approved, Aug. 13, petitions for repaving on districts Nos. 10 and 12. Both asphalt and brick are advocated.

Washington, D. C.—Orders have been issued by the district commissioners providing for a large amount of work under the assessment system.

Canton, O.—A resolution has been adopted ordering the city engineer to prepare estimates for paving N. Walnut-st. with asphalt on paving block.

Paris, Ill.—Bids will be received the latter part of September for about 6,000 square yards of brick paving on concrete foundation. L. C. Fisher, cy. engr.

Providence, R. I.—The question of paving the streets in the residence districts with macadam is being considered by the commissioner of public works.

Denver, Colo.—Plans for curbing 18 miles of streets requiring 194,000 lineal feet of sandstone curb, have been completed. H. F. Merryweather, asst. engr.

Marseilles, Ill.—The street and alley committee has been authorized to purchase stone and lay crossings at nine street intersections. Mayor Stebbins.

Louisville, Ky.—The question of paving the streets around the city hall with asphalt, at a cost of about $25,000, will be taken up soon by the council.

Leavenworth, Kas.—A resolution has been passed providing for paving two blocks of Fourth-ave. with 20 feet of asphalt in the center and 5 feet of brick on each side.

Parsons, Kas.—A resolution has been passed to macadamize Northwest Central-st., from Stevens to Fellows-ave., and Dirr-

st., from Lincoln to Fourteenth. Mayor Rockhold.

St. Joseph, Mo.—The alleys in the business district bounded by Second, Eighth, Francis and Charles-sts., will be paved with brick under the Haynes law. Mayor Combe.

Minneapolis, Minn.—Paving is contemplated as follows: Michigan-st.,4,000 feet, sandstone blocks, $25,000; Superior-st., 1 mile west of Sixth-st., sandstone, brick or asphalt.

Moline, Ill.—Ordinances have been passed providing for paving as follows: Sixteenth-st., brick, $18,361; Seventeenth-st., asphalt, $11,847; Tenth-st., brick, $23,052.

Huntington, Ind.—Resolutions have been passed for grading, curbing and graveling brick gutters and vitrified brick sidewalks on Cherry and Canfield-sts. Charles H. Cutshall, city clerk.

Bloomington, Ill.—The board of supervisors contemplate making a proposition to this city to lay an asphalt pavement around the new court house when it is completed. Mayor Thomas.

Seattle, Wash.—The board of public works has recommended improvements as follows: Grading, sidewalking and parking Blanchard-st., estimated cost, $2,400; paving with brick and curbing First-ave. S., between Yesler, Way and King-sts., $21,500.

Newark, N. J.—Ordinances have been passed for paving as follows: Asphalt on concrete, Ridgewood-ave., Fifth, S. Eighteenth and S. Twelfth, Gray and Morton-sts.; notice of intention has been published for asphalt paving on concrete on Milford-ave. and Miller-st., and for oblong granite blocks on Mt. Prospect-ave. J. Crowell Mundy, general superintendent works.

Indianapolis, Ind.—Final action was taken Aug. 24 on the following resolutions: Brick roadway and cement walks, Wabash-st., from East to Noble, and from New Jersey to East; cement walks, Massachusetts-ave., from Pratt-st. to Tenth; cement walks, York-st., from Silver-ave. to first alley northwest. Union-st., from Merrill to McCarty, will be paved with asphalt, with cement walks and curbing.

Newark, N. J.—Mayor Seymour vetoed, Aug. 27, a resolution for granite paving on concrete on Magaine-st. The resolution was adopted Aug. 16. Mayor Seymour gave as his reason for vetoing the resolution that the cost of laying granite block upon a concrete base is from $35 to $40 per city lot greater than the cost of granite block on sand, which would prove a greater burden to the property-owners than was necessary when a sand foundation would answer all the requirements for a pavement.

Indianapolis, Ind.—Improvement resolutions were adopted Aug. 29 as follows: Brick paving Cora-st.; wooden blocks, cement walks and curbing, Arch-st., from Broadway to College, and Tenth-st., from Senate-ave. to Canal bridge; cement walks and curbing, parts of Irving-place, Spruce and Twenty-third-sts. Final action was taken on the proposed brick paving for the first alley south of Prospect-st., from Virginia-ave. to Atwood-st., and for cement walks on parts of Illinois and New York-sts.

New York City.—The board of public improvements has authorized street work in Manhattan borough, with estimates as follows: Regulating and grading Tenth-ave., $58,500; paving W. Eleventh-st., $6,400; W. One Hundred and Twentieth st., $12,200; W. One Hundred and Seventy-eighth-st., $22,300; Gerard-ave., $20,000. Bronx borough, sidewalks, regulating, grading, etc., E. One Hundred and Eighty-seventh-st., $40,000; Tiebout-ave., $39,000; Clinton-place, $9,400. Brooklyn borough, paving Castor-ave., $15,000; Bleecker-st., $5,900; Woodruff-ave., $17,600; Pitkin-ave., $7,700; Barbey-st., $20,500.

CONTRACTS TO BE LET.

Wauseon, O.—Sealed bids are asked until Sept. 3 for paving Elm-st. with brick. A. S. Bloomer, vil. clk.

Hammond, Ind.—Sealed proposals are asked until Sept. 4 for paving Gostlin-st with macadam. Peter J. Lyons, cy. C. E.

Evansville, Ind.—Sealed proposals are invited until Sept. 15 for paving two alleys with brick. Geo. W. Swearingen, clk. B. P. W.

South Bend, Ind.—Sealed bids are asked until Sept. 10 for cement walks and curbing on Catalpa and Sancome-aves. L. A. Hull, cy. clk.

Springfield, Mass.—Bids are asked until Sept. 4 for 2,050 sq. yds. of asphalt paving. Arthur A. Adams. supt. sts.; Chas. M. Slocum, cy. engr.

Sturgeon Bay, Wis.—Sealed bids are asked until Sept. 4 for paving and curbing parts of Cedar and St. John-sts. Jacob Dehos, cy. clk.

Cincinnati, O.—Bids are asked until Sept. 4 for paving a portion of Spring Grove-ave. and Hoppell-st. with asphalt. Robt. Allison, prest. bd. pub. service.

Hoboken, N. J.—Bids are asked until Sept. 26 for asphalt paving on portions of ten streets and for asphalt strips on a number of streets. John Haggerty, cy. clk.

Camden, N. J.—Sealed bids are asked until Sept. 10 for building a telford road from Coffin's corner via Ashland to White Horse road, 2½ mis. J. J. Albertson, co. engr.

Columbus, Ind.—Sealed bids are asked until Sept. 3 for constructing 7-mis. and 2,970-ft. of free gravel roads in Jackson twp. Thos. May, chrmn. co. comrs.; Samuel W. Fitch, co. audt.

Mansfield, O.—Sealed bids are asked until Sept. 10 for furnishing and delivering 3,000 bbls. of American Portland cement. Robert G. Hancock, prest. Sanitar bd.; Geo. A. Clugston, secy.

Shoals, Ind.—Sealed bids are asked until Sept. 3 for building about 15 2-3 mis. of gravel or macadam roads in Perry twp. John K. Summerville, chrmn.;Horatio Harryman, co. audt.

Toledo, O.—Sealed proposals are asked for until Sept. 3 for asphalt, brick, paving block or asphalt block paving on parts of Jarvis, Page, Ewing, Locust and South-sts., and Melrose-ave. J. R. Connell, cy. clk.

Lafayette, Ind.—Sealed proposals are asked for until Sept. 10 for improving Mechanic-st. from Second to Third, and for the improvement of the west sidewalk on Wabash-ave., from Weaver to Manford-sts. Jas. K. Risk, cy. clk.

Dayton, O.—Bids are asked for until Sept. 4 for paving two streets with brick; until Sept. 17 for paving Parott-st. with brick, and for 5,650 sq. yds. of brick or block paving

and 3,300 lin. ft. of curbing on Richard-st. C. A. Herbig, prest. B. C. A.

National Military Home, Grant Co., Ind.—Proposals will be received until Sept. 3 for furnishing and delivering 10,000 paving brick; 100 bbls. of Portland cement; 75 yds. crushed stone, 1½-in. cubes or less; 1,000 ft. 6-in. wrought iron pipe. J. H. Chapman, Governor.

St. Louis, Mo.—Sealed bids are asked until Sept. 18 for grading three streets; for brick paving on concrete base, with granitoid curbing and guttering on Union Boulevard, Lombard-st. and Jefferson-ave.; telford paving on Iowa-ave. Robert E. McMath, prest. B. P. I.

Omaha, Neb.—Bids are asked until Sept. 7 for repaving with asphalt, brick or stone, curbing, etc., Twenty-fourth-st. from Farnam to St. Mary's-ave.; Twenty-fourth-st. from Farnam to Dodge; Dodge-st. from Twenty-eighth to Fortieth-st, except intersection at Thirty-ninth-st. Andrew Rosewater, chrmn. B. P. W.

Columbus Grove, O.—Bids are asked until Sept. 4 for paving High-st. as follows: 9,938 sq. yds. brick or block paving; 9,938 sq. yrs. 8-in. stone foundation and 2-in. sand cushion; 3,474 ft. 4x19-in. curbing; 1,785 ft. 5x20-in. curbing; 532 lin. ft. headers; 6,532 cu. yds. excavation; 18 catchbasins; 2,077 lin. ft. 8-in. sewer pipe; 5,000 lin. ft. common 4-in. tile; Charles Killen, cy. clk.

San Antonio, Tex.—Sealed bids are asked until Sept. 3 for the construction of about 101,000 sq. yds. of street paving, with either asphalt, vitrified brick, granite or stone blocks, mountain cedar, Mesquite, or cresoted pine blocks. Separate bids will be received for all or any part (not less than a whole street) and for curbing. Marshall Hicks, Mayor; W. W. Jackson, cy. clk.

CONTEMPLATED WORK.

Cortland, N. Y.—The Warren-Scharf Asphalt company secured the contract for paving Groton-ave.

Wauseon, O.—The contract for brick paving was awarded to J. A. Foster & Co. of Attica, Ind.

Elkader, Ia.—Stopps & Williamson secured the contract for curbing and guttering Front-st.

Scottsboro, Ala.—The contract for graveling the streets was awarded to John Francisco.

Schenectady, N. Y.—Beckwith Bros. received the contract for paving Paige-st. with brick, for $15,422.

Grand Rapids, Mich.—The contract for improving S. Diamond-st. was awarded to Gildner & Miller, for $5,700.

Washington Hill, Conn.—The contract for paving Baldwin-st. was awarded to Edward McManus, at 89 cents a square yard.

Winnipeg, Man.—The Assyrian Asphalt Paving company submitted the lowest bid for 200 to 300 tons of asphalt.

Columbus, O.—S. I. Knight secured the contract Aug. 13 for asphalt repairs on various streets for $6,361.52.

Delta, O.—C. W. Ryan, Maumee, O., secured the contract for paving and storm sewer construction in this city.

Lansing, Mich.—John Christopher secured the contract Aug. 20 for grading Main-st. at 75 cents a cubic yard.

Annapolis, Md.—George Jewell secured the contract for paving West-st. with brick with asphalt filler at $2.09 a square yard.

Elmira, N. Y.—The contract for paving Market-st. with brick has been awarded to Costello & Nagle at $1.52½ a square yard.

Middletown, O.—The contract for paving E. Third-st. was awarded Aug. 10 to F. M. Kemp & Co. for $24,590.27, for medal block.

Seattle, Wash.—McCauley & Delaney secured the contract for paving First-ave., from Madison to Pike, with brick, for $37,772.50.

Rockford, Ill.—The contracts for macadamizing Wall, Grove and Mulberry-sts. was awarded, Aug. 20, to John Rydbloom.

Watertown, N. Y.—The Warren-Scharf Asphalt Paving company was awarded the contract for paving Stone-st., for $2,585.45.

Brazil, Ind.—The contract for seven blocks of brick paving was awarded, Aug. 16, to Voorhees & Grimes, of Terre Haute, for $12,000.

Pontiac, Ill—John Cherry, jr., of Jacksonville, Ill., secured the contract for 19,000 sq. yds. of brick paving in this city, for $34,171.

Niagara Falls, N. Y.—The contract for paving Cedar-ave. with asphalt was awarded to Henry P. Burgard, of Buffalo, for $15,947.

St. Paul, Minn.—The contract for paving Mackubin-st. with asphalt was awarded to the American Contracting company for $18,966.

Milwaukee, Wis.—The contract for paving Third-st. with brick was awarded to John J. Crilley, 316 Jackson-st., at $2.22 a sq. yd.

Hartford, Conn.—The contract for paving Capitol-ave. with land asphalt was awarded to the Southern New England Paving company at $1.90 a sq. yd.

Moline, Ill.—The Barber Asphalt Paving company of Chicago was awarded the contract, Aug. 21, for paving Sixth-st. with asphalt, for $45,000.

Vincennes, Ind.—H. C. Huffstetter, of Orleans, Ind., secured the contract, Aug. 13, for building 19 4-5 mls. of gravel road in Busseron twp., for $29,975.

Sioux City, Ia.—The Barber Asphalt Paving company, New York City, secured the contract for paving Pierce and Pearl-sts., with asphalt, at $2.08 a sq. yd.

Mingo Junction, O.—The contract for building sidewalks and paving Commercial-st., has been awarded to J. Maloney, of Bellaire, O., for about $10,000.

Roseville, N. J.—The Barber Asphalt company was awarded the contract for paving with asphalt S. Twelfth, Hecker and Myrtle-sts., at $2.12 a sq. yd.

Decorah, Ia.—The contract for paving Water-st. was awarded to Canney & Howe, of Minneapolis, Minn., at $1.29 a sq. yd., using Galesburg brick.

Waterbury, Conn.—The Central Asphalt company of Hartford, Conn., was awarded a contract, Aug. 14, for paving W. Main-st. with asphalt at $2.96 a sq. yd.

Le Mars, Ia.—The contract for the construction of cement curbs and gutters was awarded to L. B. Faus, at 16 cts. a lin. ft. for curbs and 18 cts. for gutters.

Columbia City, Ind.—The contract or paving Market, Chauncey and Jefferson-sts. with brick was awarded to Frank Brumbaugh, of Elkhart, Ind., for $10,357.83.

Salem, Ill.—The contract for the construction of 50,000 ft. of granite sidewalks has been let to Patton & Hoffman, of Petersburg, Ind., at 16¾ cts a sq. ft.

London, Ont., Canada.—Harding & Leathorne secured the contract for a tar macadam pavement, with cement curb and 10-in. underdrain on Queen-ave., for $4,700.

Franklin, N. J.—Van Steinberg & Clark secured the contract Aug. 24 for sidewalks, flagging and curbing in Walnut-st., and David Harper was awarded the remainder of the work.

Wapakoneta, O.—The contract for grading, graveling and setting iron culverts in the Santa Fe pike was awarded Aug. 10 to W. J. Howell and G. W. Line for $2,357.

Camden, N. J.—The contract for paving Kaighn-ave., from the ferry house to Front-st., with Belgian blocks on concrete was awarded Aug. 8 to B. F. Sweeten & Son at 39 cents a sq. yd.

Alton, Ill.—The contract for paving Manning-st. and College-ave., in Upper Alton, with vitrified brick was awarded to David Ryan of this city at $1.09 a sq. yd. for Alton brick.

Hamilton, O.—The contract for paving North and South Second-sts. and N. Third-st. with asphalt was awarded, according to recent press reports, to the Ayres Asphalt and Paving company of Zanesville, O., at $2.17 a sq. yd.

Aurora, Ill.—Asphalt paving contracts were awarded Aug. 10 as follows: Downerplace, R. F. Conway company of Chicago, $2.04 a sq. yd.; La Salle-st., Ayres Asphalt company of Zanesville, O., $1.81.

Waynesburg, Pa.—The contract for paving and sewering the streets of this city was awarded to Ott Bros. of Allegheny at $1.61 a sq. yd.; excavating, 52 cents a cu. yd.; curbing, 62 cents a lin. ft.

East Newark, N. J.—The Barber Asphalt Paving company secured the contract for paving Second-st. with asphalt, and the Metropolitan Asphalt company the contract for paving President-st. with asphalt.

Ft. Wayne, Ind.—Bids were received Aug. 9 for paving Rockhill-st. as follows: Barber Asphalt Paving company, asphalt, $8.74 a sq. yd.; C. E. Moellering & Co., asphalt block, $9.75; Canton block, $6.65.

Lafayette, Ind.—The Western Paving company of Indianapolis has been awarded asphalt paving contracts as follows: Ninth-st., $5.18 a lin. ft.; Third-st., $4.76; Fourth-st., $5.21; Columbia-st., $5.11; Ferry-st., $5.54.

Leavenworth, Kas—The Robert J. Boyd Paving and Construction company of Kansas City, Kas., was awarded the contract for paving Second-st., from Cherokee-st. to Five-Mile creek, at $1.51 a sq. yd., or $55,000.

Manalapan, N. J.—The contract for building the new stone road from this place to the Middlesex county line was awarded to Tunis F. Conover of Manalapan, and Dr. W. T. MacMillan of Perrineville for $10,997.

Dunkirk, N. Y.—Bids were received Aug. 10 for paving E. Third-st. with brick at prices ranging from $1.07 to $1.70 for park and block brick, and 35 and 40 cents for excavation. Action on the bids was deferred.

Altoona, Pa.—(Special)—Harvey Linton, Cy. Engr., says the contract for macadamizing was awarded July 27 to Joseph Frisorn at $1.25 a sq. yd. The grade is to be low enough to admit of brick paving being laid on top of the macadam.

Detroit, Mich.—Paving contracts were awarded Aug. 14 as follows: Ferry-ave., asphalt, $2.53 a sq. yd., and Antoinette-st., $2.50, American Construction Co.; McGraw-st., cedar, J. Porath, $1.54; Sixth, G. E. Currie, $1.69; Harper, A. C. Lloyd, $1.56; Toledo-ave., H. Frederick, $1.53; Porter, J. A. Mercier, $1.68; alley, J. A. Mercier, $2.06. The lowest bids received Aug. 21 for paving, were: Kirby-ave., asphalt, American Contracting Co., $4,629.31; Field-ave., cedar, A. Grant, $17,383.89; Maybury Grand-ave., cedar, A. Lloyd, $15,613.03; Garfield-ave., cedar, J. Porath, $2,827.71.

Brooklyn, N. Y.—Bids were received Aug. 17 for asphalt paving, partly on present pavement and partly on concrete, on Carroll, Smith and Hoyt-sts., as follows: Cranford & Co.—Asphalt, 21,975 sq. yds., $2.40; relaying 4,450 sq. yds., 40 cts.; concrete, 1,223 sq. yds., $6; new curb, 8,760 lin. ft., 80 cts.; old curb, 4,200 sq. yds., 30 cts.; granite block, 1,555 sq. yds., $2.60. Alcatraz Asphalt Co.—Asphalt, $2.37; relaying, 35 cts.; concrete, $5.50; new curb, 85 cts.; old curb, 35 cts.; granite block, $2.65. Eastern Asphalt Paving Co.—Asphalt, $2.41; relaying, 35 cts.; concrete, $6.00; new curb, 85 cts.; old curb, 35 cts.; granite block, $2.65.

Albany, N. Y.—Robert A. Dumary was awarded the contract Aug. 8 for paving Third-st., and John Doyle for paving Osborne and Odell-sts. Bids were received recently for macadamizing about 2 4-5 miles of Quaker Ridge in Scarsdale, as follows: Daniel Murray, Port Chester, $23,160; Michael Desiro, Larchmont, $24,973; McCabe & Duffy, White Plains, $27,643; Lutjens & Son, Astoria, $27,713; George A. Rogers, Pittsburg, Pa., $31,000.

Wilmington, Del.—Bids were received Aug. 18 for about 10,000 sq. yds. of paving brick, as follows: John M. Solomon, Reading shale, 79 cts. per sq. yd.; John Jacoby, Townsend block, $1.12; Porter block, $1.07; Cattskill, $1.01; American Clay Mfg. Co., New Cumberland, W. Va., Porter block, $1.05; brick, $1.05; T. B. Townsend Brick & Contracting Co., Zanesville, O., Jerome block, $1.21; Athens Brick Co., Athens, O., Athens block, $1.04; Chas. Warner Co., Montello block, 94.3 cts.; Hallwood, $1.05½; Mack Mfg. Co., $1.12.

Council Bluffs, Ia.—E. A. Wickham was awarded contracts Aug. 21 for paving a number of streets with brick as follows: Graham, Park, High School and Glen-aves. and Broadway and Pierce-sts., Galesburg brick for top course and Council Bluffs brick for bottom course, $1.69 a sq. yd.; Harrison-st., Council Bluffs brick top and bottom courses, $1.33; Willow and Fifth-aves. and Bluff, Story and Fourth-sts., Galesburg brick on concrete, $1.79; Mynster-st., Des Moines brick for top course and Council Bluffs brick for bottom course, $1.62.

New York City—Bids were received recently for street improvements as follows: For paving Rector-st., asphalt blocks, Hastings Pavement company, 66 Broad-st., $3,030; Abbot-Gamble Construction company, Times building, $3,030. Paving Cedar-st. with asphalt blocks, Hastings Pavement company, $2,800; Abbot-Gamble company, $3,024. Paving W. Sixty-sixth-st. with asphalt blocks, Hastings Pavement company, $10,399; Abbot-Gamble company, $10,488. Furnishing broken stone and screenings, Brown & Fleming, 129 Broad-st., $8,288; Jacob E. Conklin, $9,350;

Manhattan Traprock company, $11,050; D. C. Bowker, jr., $11,220. Paving Carroll-st., Brooklyn, with asphalt, Brooklyn Alcatraz Asphalt company, Third-st., near Third-ave., Brooklyn, $73,402; Cranford & Co., 524 S. Marks-st., Brooklyn, $74,169; Eastern Bermuda Asphalt Paving company, 11 Broadway, $74,892. Delivering sand, Murray & Reid, $2,226; Phoenix Towing & Transportation company, $2,247; Norton & Gorman, 301 Douglas-st., Brooklyn, $2,436. Delivering broken stone, William R. Smith, $13,140; Joseph Walker, 319 E. Thirty-eighth-st., $13,200; Brown & Fleming, $15,500; Manhattan Traprock company, $13,860.

Indianapolis, Ind.—Paving contracts were awarded Aug. 24 as follows: First alley east of Delaware, from Pratt to Sahm, brick, Capitol Paving and Construction company, 91 cts. a lin. ft.; grading and curbing roadway of first alley east of Illinois-st., from McLean-place to Twenty-second-st., Geo. W. McCray, 37½ cts. a lin. ft.; grading and graveling first alley east of Capitol-ave., P. E. Phillips, 17 cts. a lin. ft.; brick paving, with cement walks and curbing, Spruce-st., from Prospect to Lexington-ave., P. F. Toll, $1.17 a lin. ft.; brick paving, with cement walks and curbing, Pierson-st., Jos. R. Cooper, $2.57 a lin. ft.; asphalt paving, with cement walks and curbing, Bird-st., Warren-Scharf Asphalt Paving company, $3.73 a lin. ft.; gravel roadway, with cement walks and curbing, Ruth-st., Roger & Dunlap, $1.65 a lin. ft.; grading and graveling Georgia-st., from Shelby to Leota, Harry Roberts, 79 cts. a lin. ft. Contracts were awarded Aug. 29 as follows: Asphalt paving, brick gutters and resetting curb, Bellefontaine-st., from Massachusetts-ave. to Fifteenth-st., Warren-Scharf Asphalt Paving company, $4.15 and $3.75 a lin. ft.; asphalt and curbing, Meridian-st., from Twenty-fifth-st. to south end of Fall creek bridge, Indiana Bermudez Asphalt company, $5.15 a lin. ft.; cement walks and curbing, Arsenal-ave., from Washington-st. to P., C., C. & St. L. Ry., W. C. Allen, $1.30 a lin. ft.; cement walks, Harlan-st., from Prospect-st. to Pleasant run, Julius Keller, 57 cts. a lin. ft.; cement walks, Hendricks-st., from Lincoln to Nebraska, Julius Keller, 57 cts.; cement walks, Morris-st., from East to Wright, Julius Keller, $1.15 a lin. ft.

SEWERS.

Delaware, O.—The state board of health has ordered that the plans for this city's new sewerage system be changed so as to provide for the purification of the sewage before it is discharged into the Olentangy river.

Chicago, Ill.—Work has begun on the new Halsted-st. sewerage system at West Pullman. The sewer will be of brick, four and one half feet in diameter at the outlet into the Calumet river at Halsted-st., and will sewer all of that part of the city lying east of Ashland-ave., south of One Hundred and Fifteenth-st., and west of Wallace-st. It will cost $78,000.

CONTEMPLATED WORK.

Oregon City, Ore.—A system of ten and twelve-in. pipe sewers in the district between Second and Seventh-sts., and Center-st and Eastham school is contemplated.

Pocahontas, Ia.—A sewer system will be built.

Bordentown, N. J.—A sewerage system is contemplated.

Newton, Ia.—Plans are being prepared for a sewerage system.

Watertown, S. D.—Bids will be asked soon for a sewerage system.

Sumter, S. C.—A sewerage system, to cost about $60,000, is contemplated.

Shenandoah, Ia.—Plans and estimates are being made for a sewerage system.

Mt. Carmel, Pa.—A sewerage system is proposed. Wm. Camp, chrmn. sewer com.

Virginia, Minn.—Profiles and estimates for a sewer will be prepared by J. D. Lamont.

Rat Portage, Ont.—The council voted to build sewers in Julia, Lottie and Agnes-sts.

Central Falls, R. I.—The council has appropriated $4,900 for a sewer in Watrus-st.

Washington, Ia.—Resolutions are pending providing for a number of sewers. Mayor Ross.

Waterloo, Ia.—This city has voted to build a sewer to drain the lower parts of the city.

Hamilton, O.—An ordinance has been passed for sewers in Tenth and High-sts. M. O. Burns, cy. clk.

St. Cloud, Minn.—Plans are being prepared by the city engineer for a system of lateral sewers.

Helena, Ark.—An engineer will be engaged to prepare plans and specifications for a sewerage system.

Augusta, Ga.—An ordinance has been approved for a sewer in Fifteenth-st. J. S. Patterson, clk. coun.

Florence, Ala.—Plans and specifications for a sewerage system have been completed; estimated cost, $50,000.

New Britain, Conn.—Plans for a complete sewage disposal system have been completed by City Engineer Cadwell.

Bridgeport, Conn.—Bids will be asked soon for sewers on Stratford and Wilmot-aves. Albert E. Lorey, cy. clk.

Erie, Pa.—Mayor Depinet has approved an ordinance for a 30-in. main sewer in McCarter and East-aves.

Altoona, Pa.—The construction of sewers is contemplated in a large number of streets. Harvey Linton, cy. engr.

South Framingham, Mass.—The question of issuing $30,000 bonds for building trunk sewers is being considered.

Akron, O.—An ordinance has been passed providing for a main trunk sewer in Dist. No. 9. Chas. H. Isbell, clk.

Huntington, Ind.—A resolution has been passed to build a sewer in Canfield-st. Chas. H. Cutshall, cy. clk.

Centralia, Ill.—Plans and estimates for a complete sewerage system are being considered by the sewer committee.

Loveland, Colo.—A resolution has been adopted to take preliminary steps toward securing a sewerage system.

Davenport, Ia.—The estimated cost of the proposed district sewer, according to City Engineer Murray, is $21,650.

Columbus, O.—Plans for sewer extensions and improvements have been prepared by City Engineer Griggs, which will cost about $182,625. Mr. Griggs recommends the immediate expenditure of $98,685.

Keokuk, Ia.—A resolution of intention to build sewers in a number of streets has been passed. J. F. Daugherty, mayor.

Seattle, Wash.—A resolution has been passed providing for a sewer in Thirtieth-st. S. W. V. Rhinehart, pres. cy. coun.

Indiana, Pa.—George R. Stewart and J. T. Bell compose a committee appointed to investigate the cost of building a sewerage system.

Winchester, Ind.—C. E. Yunker, city engineer, has been directed to prepare plans and specifications for a complete sewerage system.

Haddonfield, N. J.—The mayor has been instructed to appoint a committee to secure plans and specifications for a sewerage system.

Batavia, N. Y.—The septic tank sewage plan submitted to the sewer commissioners will be examined by Emil Kuichling of Rochester.

Cleveland, O.—Ordinances have been passed for sewers in Forman, Elmwood, Reade, Beacon, Heath and B-sts. Howard H. Burgess, cy. clk.

Cincinnati, O.—The estimated cost of building sewers in Congress and Kellogg-aves. is $20,271, and in Kellogg and McCullough-aves. $19,374.

Sandy Hill, N. Y.—Surveys for a sewerage system have been completed by Charles Derleth, jr., of Columbia college, New York City, who estimates the cost at $67,400. The question of construction will probably be voted on.

Collingswood, N. J.—Sewage disposal works will be built from the plans of the City Wastes Disposal company of New York City. The system includes septic tank treatment and subsequent aeration of the effluent in coke filters.

Marshalltown, Ia.—(Special)—The city council has engaged George S. Pierson, M. Am. Soc. C. E., of Kalamazoo, Mich., to prepare plans for sewage disposal. The plant will have a capacity of 2,000,000 gallons a day and will require a pumping station.

Holland, Mich.—Bids will be asked soon for a sewerage system. Alvord & Shields of Chicago have prepared the plans, which provide for the bacterial system. Two purification plans will be constructed and one mile of main sewer will be built.

Petaluma, Cal.—(Special)—N. S. Frost, city engineer and superintendent of streets, says that this city has under consideration the construction of 1,350 feet of 6-in. pipe sewer on B-st., and about 600 feet of 8-in. on Washington-st. The city has just completed 1,400 feet of 8-in. pipe sewer on Dewey and Bremen-sts.

Newark, N. J.—City Surveyor Ernest Adam has been directed to have specifications printed for the central relief sewer; estimated cost, $98,652. Ordinances of intention have been published for sewers in Ward and Franklin-sts. The new apportionment of the cost of the proposed joint sewer is as follows: West Orange, $71,892, 2,501,177 gals.; Milburn, $39,538, 1,551,224 gals; Irvington, $54,803, 2,391,004 gals.; Vailsburg, $35,427, 1,543,882 gals.; Summit, $76,978, 3,000,000 gals.; South Orange Village, $69,762, 2,425,250 gals.; Newark, $33,884, 1,478,363 gals; totals, $382,434, 14,891,000 gals.

CONTRACTS TO BE LET.

Des Moines, Ia.—Bids are asked until Sept. 12 for building 3,260 feet of thirty-six-inch two-ring brick overflow sewer. B. P. W.

Jackson, Miss.—Bids are asked until Sept. 4 for about ten miles of sewer. John W. Todd, Mayor; Oliver Clifton, clerk.

Wausau, Wis.—Bids are asked until Sept. 3 for building sewers on Clark, Main and McClellan-sts. Charles F. Beck, city clerk.

Billings, Mont.—Bids are asked until Sept. 4 for enlarging a ditch. C. M. Chaffee, secretary, Yellowstone & Canyon Creek ditch company.

Bowling Green, O.—Bids are asked until Sept. 25 for about 6,000 feet of thirty-inch pipe sewers. Riggs & Sherman, engineers, Toledo.

Toledo, O.—Sealed bids are asked until Sept. 10 for building sewers in Whittemore-st. and an alley. John E. Connell, city clerk.

Galion, O.—Bids are asked until Sept. 18 for about 7,900 feet of twelve to twenty-four-inch pipe sewers. J. W. Atkinson, city engineer; J. R. Homer, mayor.

Washington, D. C.—Sealed bids are asked until Sept. 8 for building sewers in the District of Columbia. B. F. McFarland, chairman district commissioners.

Red Jacket, Mich.—Sealed bids will be received until Sept. 4 for the extension and building of a storm sewer of 1,000 feet, more or less. Albert J. March, clerk.

Boston, Mass.—Sealed bids are asked until Sept. 17 for building sections 56 and 57 of the metropolitan sewer in Chelsea. William M. Brown, jr., chief engineer metropolitan sewerage committee.

Mansfield, O.—Sealed bids are asked until Sept. 10 for building a 20-inch intercepting sewer, and for furnishing and delivering vitrified salt-glazed sewer pipe. George A. Clugston, secretary sanitary board.

Hammond, Ind.—Bids are asked until Sept. 4 for relaying the sewer in Rimbach-ave., the sewer to be an eighteen-inch vitrified main sewer, with manholes, catch-basins and house connections. Peter J. Lyons, city civil engineer.

Cleveland, O.—Sealed bids are asked until Sept. 6 for constructing house sewers and water connections in ten streets and avenues. Bids are asked until Sept. 4 for a sewer in Scranton-ave. John Vandevelde, deputy director public works.

CONTRACTS AWARDED.

Columbus, Ind.—Lyle & Prather secured the contract for the Eighth-st. sewer for $6,444.

Wells, Minn.—The contract for a sewer was awarded to R. F. Weston of this city.

Lead, S. D.—The contract for a sewer tunnel was awarded to Lashley & Price.

Two Harbors, Minn.—The contract for a sewer on Third-ave. was awarded to P. G. Pastoret.

Troy, N. Y.—Ellis Bros. secured the contract for a sewer in Jacob-st. at $10.30 a lin. ft.

Lafayette, Ind.—W. F. Frey was awarded the contract for a pipe sewer on Ferry-st. for $16,320.60.

Elizabeth, N. J.—Matthew Wade secured the contract for the Henry-st. brick sewer for $16,652.

Annapolis, Md.—The contract for sewers was awarded to A. L. Patterson & Co. for $5,665.

Pittsburg, Pa.—Dunlus Bros., 3903 Boundary-st., secured the contract for sewers in Bennet-ave., for $4,647.

Seattle, Wash.—Mitchell & Hard secured the contract for a sewer in Eighteenth-ave. for $3,598.

Durand, Mich.—The contract for two lateral sewers has been awarded to Thomas McMahon of Port Huron.

Scranton, Pa.—John J. Fahey secured the contract for a sewer in Meade-ave. for $6,034.80.

Dayton, O.—Contracts for sanitary sewers were awarded Aug. 20 to William Rehling of Richmond, Ind., for $16,795.

Altoona, Pa.—(Special)—Contracts were awarded July 27 to W. H. Herr, C. B. Clark and W. W. Saup & Co. for 21,857 ft. of sewers.

Rawlins, Wyo.—The contract for a sewerage system was awarded to Thomas Scanlon of Denver, Col., for $21,000.

Columbia, Mo.—The contract for a sewarage system was awarded to W. H. Kolkmeyer of Jefferson City, Mo., for $13,983.90.

Ottumwa, Ia.—Edward G. Keefe was awarded the contract for building the Blakes' Branch sewer, for $28,860.

Astoria, N. Y.—The contract for a new sewer in Flushing-ave. has been awarded to William Clapp of Brooklyn, for $35,590.

Houston, Tex.—The contract for sewers has been awarded to Jerry Shea of Quincy, Ill., for $300,000, according to press reports.

Sheboygan, Wis.—J. H. Green & Sons of Appleton, Wis., have been awarded the contract for a sewer in this city for $20,000.

Fond du Lac, Wis.—The contract for a sewer on Portland-st. has been awarded to Ahern & Sons, and on Merrill-st. to C. L. Pierce.

Salt Lake City, Utah.—The contract for taking up 10,000 ft. of old sewer pipe was awarded to Kiefer & Rush, at 29 cts. a lin. ft.

Racine, Wis.—Sewer contracts have been awarded as follows: Prospect-st., James Cape & Sons; Albert-st. and Morton-ave., Hansen & Thompson.

Racine, Wis.—Sewer contracts were awarded to Hansen & Thompson, as follows: Tenth-st., $2,057; Ninth, Elm, Cherry and Walnut-sts., $1,535.

Baton Rouge, La.—The contract for 15 miles of pipe sewers, 120 manholes and 20 flush tanks was awarded to L. W. Brown of New Orleans, for $52,300.

Florence, Ala.—The contract for building a new sewer for the proposed new sewerage system was awarded to Neely & Smith of Chattanooga, Tenn., for $45,000.

Collingswood, N. J.—The Collingswood Sewerage company contracted Aug. 6 for a sewage disposal plant, after plans prepared by the City-Wastes Disposal company of New York City.

San Rafael, Cal.—Bids were received from nine contractors Aug. 17 for a sewerage system, ranging from $24,000 to $38,000. Action on these bids was deferred.

Livingston, N. Y.—The contract for building a new filter bed in connection with the sewerage system at Craig Colony has been awarded to Joseph H. Kelly of Mt. Morris.

Chicopee, Mass.—The contract for building the Williamsett sewer was awarded to Sullivan & Enright of Chicopee Falls, for $16,134, according to press reports.

Toledo, O.—Sewer contracts were awarded, Aug. 9, as follows: Greenwood-ave., dist., Pat Kelly, $2,633. Austin-st., John McMahon, $5,813; Millard-ave., J. E. O'Neill, $4,195.

Alexandria, Ind.—Bids were received Aug. 17 for 9,000 ft. of brick and pipe sewers, 26 manholes, 14 catch basins and inlets and 4 flush tanks, as follows: S. J. Brandon, $14,798; R. L. King, $13,262; P. T. O'Brien, $14,414.

Denver, Col.—The J. M. O'Rourke Const. company secured the contract for the construction of sub-district No. 20 Capitol Hill storm sewer. The contract was originally awarded to the James Carbis company, which refused to do the work.

Milwaukee, Wis.—Sewer contracts have been awarded as follows: Eighteenth-ave. and Burnham-st., Daniel Driscoll, $1.19 a lin. ft.; Burnham-st., G. E. Zimmerman, $1.18; South alley, James O'Donnelly, $1.39; Auer-ave., Herman Hohensee, $1.20; Eighteenth-st., Herman Hohensee, $1.14.

Syracuse, N. Y.—The lowest bid submitted Aug. 13 for a trunk sewer system in the First ward was that of Frank S. Sposato, for $32,220.50. The other bids were Thomas F. Moore, $41,897.01; Charles Smith, $54,667.70; M. R. Grannis, $44,597.50; Thomas Marnell, $39,337.50.

Waterford, N. Y.—Bids were received Aug. 18 for building the new Eighth ward sewer as follows: William Stanton, Cohoes, $7,235.09; Albert M. Banker, Gloversville, $11,400.95; John B. Doyle, Cohoes, $7,196.65; Mooney & Lillis, Troy, $7,648.25; Harrington & Besch, Troy, $8,922.62; Eveline & Donello, Troy, $6,879.49.

Vineland, N. J.—A contract for constructing sewage disposal beds was awarded to Jekiel Vaughn, of Stamford, N. Y., as follows: Excavation, 30 cts., with 10 cts. for extra haul; 15-in. pipe laid, 55 cts.; 12-in., 40 cts.; 10-in., 35 cts.. 8-in., 28 cts; 6-in., 24 cts.; brickwork, $16 per M.; Portland cement concrete, $6; 15-in. disk valves furnished and set, $16; 12-in., $11; 10-in., $9; 8-in., $6.50; 6-in., $5.

Lakewood Hamlet, O.—(Special)—Bids were received Aug. 21, for a sewerage system. The contracts will be awarded Sept. 19. The bids on section 1 ranged from $19,226.70 to $33,603.88; on section 2, from $16,344.90 to $31,405.01; section 3, from $16,004.40 to $32,208.59; on sewage disposal plant, from $1,992.50 to $30,721.50; on sewerage tunnel and short siphon, from $37,857.50 to $90,256.25; on long siphon, from $16,014 to $14,992.75.

WATER-WORKS.

Wisner, Neb.—Municipal ownership of water works has been decided upon by this city.

Marshall, Mo.—This city will purchase the water works on Nov. 18, on which date the franchise expires.

Lafayette, Ind.—This city has presented the Purdue university with a 2,000,000 gal. water works pumping engine for use in the laboratory.

Sheboygan, Wis.—This city has appointed Daniel W. Mead of Chicago and John B. Heim of Madison, Wis., as appraisers to meet George H. Benzenberg of Milwaukee

and John W. Alvord of Chicago, appraisers appointed by the water works company, and Benezette Williams, appointed jointly, to appraise the water works system of this city for purchase by the city.

Eau Claire, Wis.—The water works owned by a private company have been appraised by commissioners appointed for the purpose at $272,000.

CONTEMPLATED WORK.

Augusta, Ga.—The council will expend $41,649 on improving the water mains.

Laurel, Md.—Plans for a municipal water and light plant have been completed.

Two Rivers, Wis.—New bids will be asked for building water works and electric light plants.

Moscow, Russia.—The water works are to be enlarged and improved at a cost of about $7,000,000.

Rock Island, Ill.—The purchase of a pump and the extension of the water mains is proposed.

Randolph, Neb. — (Specal.) — Additional mains, an open well and a new pumping plant are contemplated.

La Salle, Ill.—The city council voted Aug. 18 to expend $60,000 for improving the water works plant.

Braddock, Pa.—This town has voted to issue bonds for improving the water works, streets and town hall.

Monroeville, Ind.—The board of trustees has decided to build municipal water works and electric lights.

New Florence, Pa.—An ordinance has been passed providing for the issue of $14,000 bonds for municipal water works.

Elkhart, Ind.—A committee has been appointed to investigate the advisability of municipal ownership of the water works. Mayor Turner.

The question of issuing water works bonds will be voted on at the following places: Mondovi, Wis., Sept. 8; Stewart, Minn., and Vallejo, Cal.

New Orleans, La.—The executive committee of the sewerage and water board has recommended water purification experiments which have been adopted by the board.

Water mains extensions are contemplated at the following places: Traverse City, Mich.; Leslie, Mich.; Mokena, Ill.; Rock Island, Ill.; Red Bank, N. J.; Abington, Pa.; Stuart, Va.

Joliet, Ill.—The city council has adopted a report from the water committee recommending detailed plans and making specifications from Daniel W. Mead for improving the water works system.

Dunkirk, N. Y.—The water board voted Aug. 10 to issue $124,000 bonds for improvements to the water system, including a new intake pipe, additional machinery, a new pumping station and new buildings.

The question of issuing water works bonds has been favorably voted on at the following places: Prairie Depot, O.; West Plains, Mo.; St. Mary's, W. Va.; East Bangor, Pa.; Lindstrom, Minn.; Moravia, N. Y.; Jamestown, N. D.; Smyrna, N. Y.; Homer, Mich.; Kirkland, Ill.; Manson, Ia.

Providence, R. I.—The joint special committee has recommended the purchase of a 20,000,000 gal. filtration plant. The committee suggests, also, that the mayor appoint a commission of three to ascertain the cost of securing a new water supply from the Pawtuxet river above the chief sources of pollution.

The construction of water works systems is contemplated at the following places: Prescott, Ariz.; Arlington, Ia.; Deer River, Minn.; Chickasa, Ind. Ter.; Virginia, Ill.; Ogden, Utah; Collins, Ia.; St. Charles, Mich.; Virden, Ill.; Wenatchee, Wash.; Grand Rapids, Mich.; Harrison, Idaho; Sturgeon Bay, Wis.; Tell City, Ind.; Havre, Mont.; Washington, Kas.; Alfred, N. Y.; Williamsburg, Pa.; Vermontville, Mich.; Lincoln, Ill.; Oakland, Ill.; Elma, Ia.; La Motte, Ia.

CONTRACTS TO BE LET.

Wheaton, Minn.—Sealed bids are asked until Sept. 7 for a water works plant. A U. Fitzgerald, vil. rec.

Clarksdale, Miss.—Bids are asked until Sept. 18 for a water works and sewerage system. Walter Clark, mayor.

Hyattsville, Md.—Bids will be received until Sept. 12 for a complete water system. Dr. J. R. Owen, pres. coun.

Iola, Kas.—Sealed bids are asked until Sept. 11 for a water works system. W. H. McClure, mayor; W. M. Knapp, cy. clk.

Bridgeton, N. J.—Sealed bids are asked until Sept. 11 for a pumping engine. Joseph H. Powell, chrmn. water com.

Detroit, Mich.—Sealed bids are asked until Sept. 11 for two 25,000,000 gal. pumping engines. John W. McGrath, prest. bd. water comrs.

Solvay, Minn.—Bids are asked until Sept. 10 for the construction of a brick cistern and a frame engine house. Jay W. Near, vil. rec.

Alliance, O.—Bids are asked until Sept. 5 for a water tower at the Fairmount Children's home. Joint board of comrs. of Stark and Columbia cos.

Boston, Mass.—Sealed bids are asked until Sept. 25 for building the Wachusett dam in Clinton, Mass. Henry H. Sprague, chrm. Met. water bd.

Cincinnati, O.—Sealed bids are asked until Oct. 16 for four 30,000,000 gal. pumps for the California works. Aug. Herrmann, prest. bd. trustees.

Mansfield, O.—Sealed bids are asked until Sept. 10 for building an 8-in. cast iron inverted siphon and a 10-in. cast iron force main. Geo. A. Clugston, secy. sanitary bd.

Pittsburg, Pa.—Sealed bids will be received until Sept. 4 for constructing a reservoir in Highland park; for furnishing and erecting two compound, condensing, high duty pumping engines; for the purchase of scrap metal made in the removal of the old pumping engines at the Brilliant pumping station. Geo. W. Wilson, dir. dept. pub. wks.

CONTRACTS AWARDED.

Greene, Ia.—The contract for a water works system was awarded to Fairbanks, Morse & Co., for $10,000.

Woonsocket, S. D.—The contract for 3,000 feet of water mains was awarded to Austin & Lewis of Mitchell, S. D.

Vailsburgh, N. J.—The contract for extending the water mains has been awarded to Frank W. Snyder for $4,166.67.

Staples, Minn.—The contract for a water works sytem was awarded to Fairbanks, Morse & Co. of St. Paul for $3,540.

Prescott, Ariz.—Press reports state that the contract for water works was awarded to G. W. Sturtevant for $153,588.

South Haven, Mich.—The contract for a water works system has been awarded to R. C. Houston & Co. of Chicago for $20,000.

St. Louis, Mo.—Contracts were awarded, Aug. 10, for material for water works mains as follows: United States Cast-iron Pipe and Foundry company for $128,497.60; valves to the Fulton Iron Works for $1,785.50; 170 tons of special castings to the United States Cast-iron Pipe and Foundry company for $7,480.

Randolph, Neb.—(Special).—The contract for laying about half a mile of the extensions to the water mains was awarded to E. C. McCashland of Grand Island, Neb., and the contract for furnishing the necessary pipe and specials was let to M. J. Drummond & Co., New York.

New Orleans, La.—Morill & Cragin have proposed to this city to supply at least 50,000,000 gal. a day of pure, wholesome water by gravity, from a source free from contamination and not requiring filtration. The price asked is $42.50 per 1,000,000 gals. for not less than 50,000,000 gals. daily, or a higher price for a smaller supply, and the city would be required to purchase eventually the conduits to be laid at a cost of $12,000,000 to $15,000,000 for bringing the water to the city.

BRIDGES.

Unionville, Mo.—Bids are asked until Sept. 5 for building bridges. A. L. Davis, bridge commissioner.

Hammond, Ind.—The county commissioners contemplate building a bridge at Hohman-st.

Troy, O.—Bids are asked until Sept. 7 for two steel bridges—one at Troy and one at Piqua. J. T. Bartmess, county auditor.

Hartford City, Ind.—Sealed bids are asked until Sept. 5 for two iron or steel bridges and four stone culverts. B. F. Wampler, county auditor.

Norristown, Pa.—Sealed bids are asked until Sept. 10 for a stone arch bridge in Upper Salford township. John Hampton, chairman commissioners.

Milwaukee, Wis.—The plans submitted by the J. G. Wagner company for the new Grand-ave. bridge have been accepted by the board of public works.

Wellsburg, W. Va.—The county commissioners have decided to build an iron bridge over Buffalo creek. Bids will be received in September.

Jasper, Ala.—Bids are asked until Sept. 6 for a steel highway bridge across Tan Yard creek, with two stone abutments. L. M. Smith, cy. sec.

Dartmouth, Mass.—The question of building a new bridge at Padanaram to replace the present wooden one is being considered.

Batavia, O.—Bids are asked until Sept. 15 for a 90-ft. bridge across Nine Mile creek. John W. Davis, auditor and clerk.

Vassar, Mich.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for a bridge across Cass river, for $1,975.

Allentown, Pa.—A steel bridge, from Allentown to Salisbury township, is contemplated. E. T. Clymer and M. C. L. Kline interested.

Oak Creek, Wis.—This town contemplates building a bridge over Root river, at a cost of $3,200.

Clarion, Pa.—Plans and specifications for a $40,000 bridge across Clarion river will be made by W. H. Gulick of Phoenixville.

Rome, N. Y.—The common council decided Aug. 20 to accept the engineer's plans for a new bridge over Fish creek, at Brodocks, and order bids advertised.

Muncie, Ind.—Sealed bids are asked until Sept. 8 for a bridge across the Mississinewa river near Wheeling. Bids are asked until Sept. 3 for a bridge in Union twp. Robt. W. Munroe, co. audt.

New York City.—The new East river bridge commission has been temporarily enjoined by Judge Fitzgerald of the New York supreme court from awarding the contract for building the two approaches to the bridge. The injunction was returnable Aug. 23.

PARKS.

South Orange, N. J.—A park along Grove road is proposed.

York, Neb.—Negotiations are pending for the purchase of the Goosen tract of seven acres on Beaver Creek, for a park site.

Evansville, Ind.,—The women of the federated organizations have made possible the purchase of the Armstrong property as an extension to Sunset park.

Pittsburg, Pa.—The residents of the South Side are urging the adoption of plans for a small park between Carson, S. Twenty-second and Twenty-third-sts., and the Monongahela river.

Indianapolis, Ind.—The park board recommendations for appropriations for next year have been submitted to the city comptroller and include the following: Office expenditures, $7,530; Garfield park, improvements, $10,000, maintenance $12,950; Military park, maintenance, $3,230; University square, improvements $1,000, maintenance $1,540; St. Clair square and Fort Wayne triangle, maintenance $1,150; Hendricks, Fletcher and Oriole, improvements $300, maintenance $850; Fletcher-place and East Eleventh-st. centers, maintenance $21,120; Greenlawn, improvements $1,000, maintenance $3,245; Morton-place, maintenance $850; Morris park, improvements $600, maintenance $550; Brookside, improvements $14,000, maintenance $10,000; Riverside, improvements $124,000, maintenance $29,000; Indianola square, maintenance $1,500; Highland square, improvements $4,000, maintenance $2,200; Spades-place and Elmwood, improvements $2,500, maintenance $2,500; total improvements $157,400, total maintenance $72,475.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Wichita, Kas.—A crematory is proposed. Mayor Ross.

Columbia, S. C.—The board of health has asked council for funds to establish a garbage crematory.

Oil City, Pa.—Bids are asked until Sept.

10 for a garbage crematory. S. W. Barnhart, controller.

Toledo, O.—An ordinance has been passed to sweep and otherwise clean Robinwood-ave. John E. Connell, cy. clk.

McKeesport, Pa.—The question of purchasing a sprinkler, a street sweeper and two wagons is being considered by the council. R. A. Hitchins, cy. compt.

Salt Lake City, Utah.—The committee appointed to investigate the construction of a crematory to replace the one burned recently, reports that an incinerator would cost between $20,000 and $25,000. Dr. King, health comr.

STREET LIGHTING.

Monroeville, Ind.—A municipal lighting plant is contemplated.

Morrice, N. Y.—The electric light plant, which burned recently, will be rebuilt.

Galesburg, Ill.—The city council voted recently to build a municipal light plant.

Springfield, O.—O. S. Kelly has asked for a franchise for a commercial lighting and heating plant.

Fairview, N. J.—Bids are asked until Sept. 5 for lighting the streets of this city. Mayor Ayres.

Kirkwood, Mo.—Bids are asked until Sept. 20 for a municipal electric light plant. W. W. Daly, mayor.

Iola, Kas.—Sealed bids are asked until Sept. 11 for an electric light system. W. M. Knapp, cy. clk.

Coffeyville, Kas.—The question of issuing bonds for an electric light plant will be voted on Sept. 4.

Saginaw, Mich.—The contract for lighting the city for five years was awarded to the Bartlett Illuminating company.

Tamaqua, Pa.—Bids are asked until Sept. 5 for furnishing 802,000 c.-p. arc lights. W. F. Leopold, town clk.

Fort Recovery, O.—Sealed bids are asked until Sept. 20 for a power house, pumps, engines and boilers. Fred Tegler, clk.

Los Angeles, Cal.—Bids are asked until Sept. 5 for a franchise to operate a plant in Los Angeles county. C. W. Bell, co. clk.

Santa Rosa, Cal.—The contract for street lighting has been awarded to the Merchants' Lighting company at $5.50 per light per month.

Algonac, Mich.—The contract for erecting an electric light system has been awarded to T. C. Brook & Co. for $12,225.

Birmingham, Ala.—The contract for lighting this city was awarded to the Consolidated Electric Light company for 10 yrs.

New London, Conn.—Bids are asked until Sept. 6 for one 50-K. W. generator set and accessories. Maj. Smith S. Leach, U. S. Engr.

Fredericksburg, Va.—Bids are asked until Sept. 18 for a street lighting electric plant of 80 arc lamps of 2,000 c. p. F. P. McCracken, chrmn. com. on lgt.

Ann Arbor, Mich.—Sealed bids are asked until Sept. 15 for lighting the streets, alleys and public places with electricity for 5 yrs. Jas. E. Hawkins, cy. clk.

Crawfordsville, Ind.—The city council has ordered that the plant be advertised for lease for a term of ten years. The plant originally cost $80,000, but after ten years of municipal lighting the city decided to lease it.

Vailsburg, N. J.—The contract for lighting the streets was awarded to the Peoples' Electric Light and Power company for 5 yrs. for 30 arc lamps at $90 a year, and $10 a year for 40 or more incandescent lamps.

Corning, N. Y.—The contract for lighting the city with arc electric lights has been awarded to Robert Drake of Syracuse, N. Y., at $80 per light of 2,000 c. p. light for an all-night schedule.

Ishpeming, Mich.—A contract has been entered into with the Negaunee & Ishpeming St. Ry. & Elect. Co. for 2,000 c. p. lights at not more than $10 nor less than $9 per month; 1,200 c. p. lights at not more than $8.25 nor less han $7.50 per monh.

Electric light plants are contemplated at the following places: Bergen, N Y.; Hepworth, Ill.; Alden, Minn.; Plymouth, Wis.; South Glens Falls, N. Y.; Astoria, Ill.; Juneau, Wis.; Litchfield, Ill.; St. Joseph, Mich.; New Castle, Colo.; Ft. Scott, Kas.

Lewiston, Me.—The American Light and Power company was awarded the contract for electric street lighting for 5 yrs at $37 per light, the city to use not less than 95 lights to burn all night when necessary, and not less than 25 nights per month.

La Crosse, Wis.—The La Crosse Brush Light company has proposed to furnish light at $80 per light per annum, for 7 yrs., after the expiration of which time the company will sell the plant to the city. The committee on lights has recommended the acceptance of the proposition.

Oklahoma City, O. T.—A franchise for new gas works was granted J. B. Jones of Chicago, Aug. 20, for a period of 21 yrs. The plant wil cost $40,000. The minimum price of gas for fuel for lighting purposes is fixed at $1.25 per 1,000 ft., and at $1 per 1,000 ft. when the consumer uses 5,000 ft. or more per month.

Milwaukee, Wis.—The common council was to consider, at its meeting, Aug. 27, the recommendation of Mayor Rose for a 3-yr. contract for lighting the streets. The board of alderman, with the exception of Alderman Grogan, favors a 5-yr. term, as they do not believe that a municipal lighting plant will be in operation much before 1906.

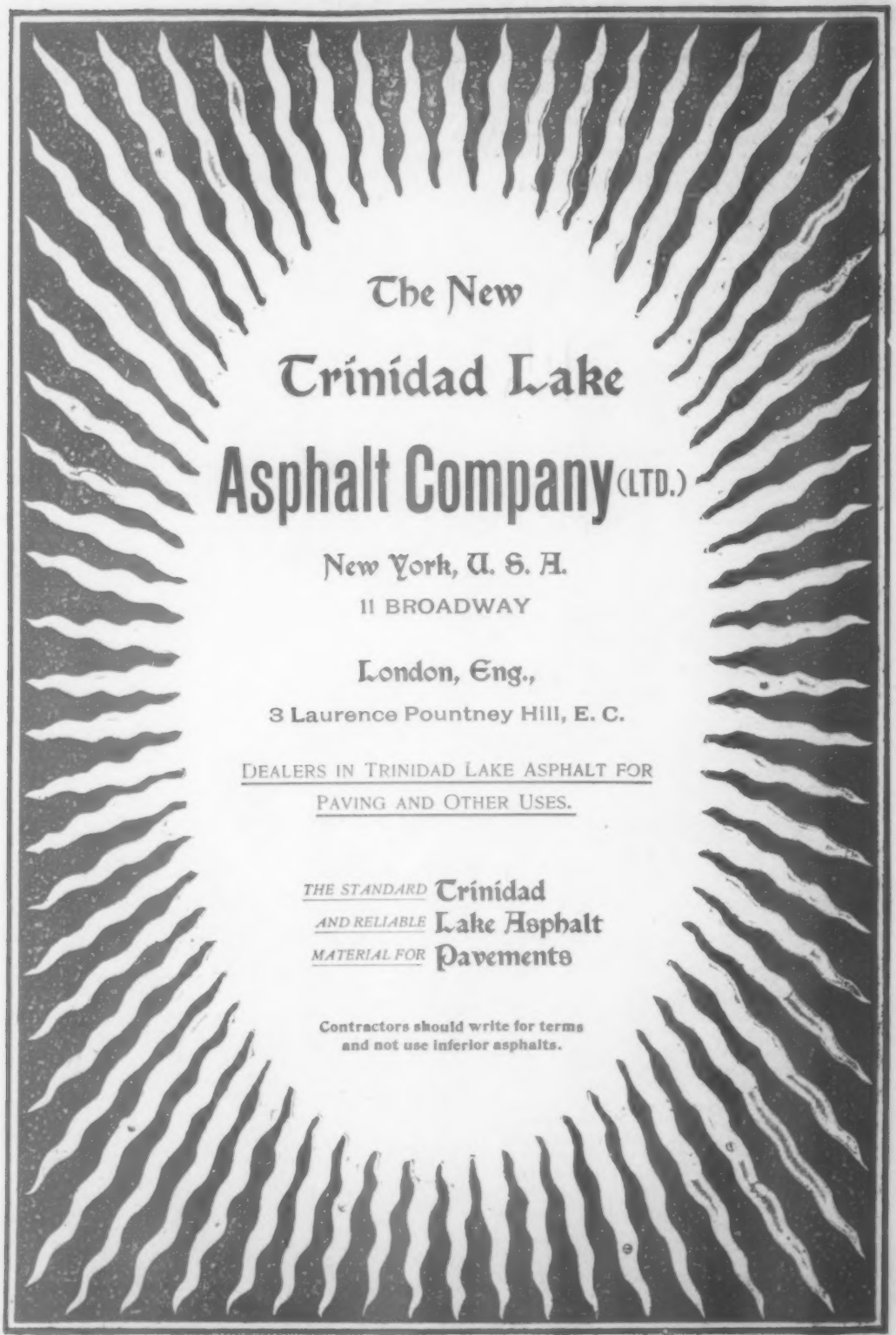
TOO LATE FOR CLASSIFICATION

Fresno, Cal.—Bids will be received Sept. 17 for lighting the streets for a year. Cy. clk.

Oxford, O.—A resolution has been passed providing for cement or sandstone walks in a number of streets. J. A. Kennedy, clk.

Toledo, O.—Sealed bids are asked until Oct. 1 for furnishing street signs to mark the street corners of the city. J. E. Connell, cy. clk.

Council Bluffs, Ia.—The city clerk was authorized, Aug. 23, to advertise for bids for asphalt paving in parts of Sixth, Seventh, and Eighth-sts., and First, Willow, Fifth, Fourth and Third-aves., and for brick paving in Ninth and Sixth-sts. and Sixth-ave.


The New
Trinidad Lake
Asphalt Company (LTD.)
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London, Eng.,
3 Laurence Pountney Hill, E. C.
DEALERS IN TRINIDAD LAKE ASPHALT FOR
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THE STANDARD Trinidad
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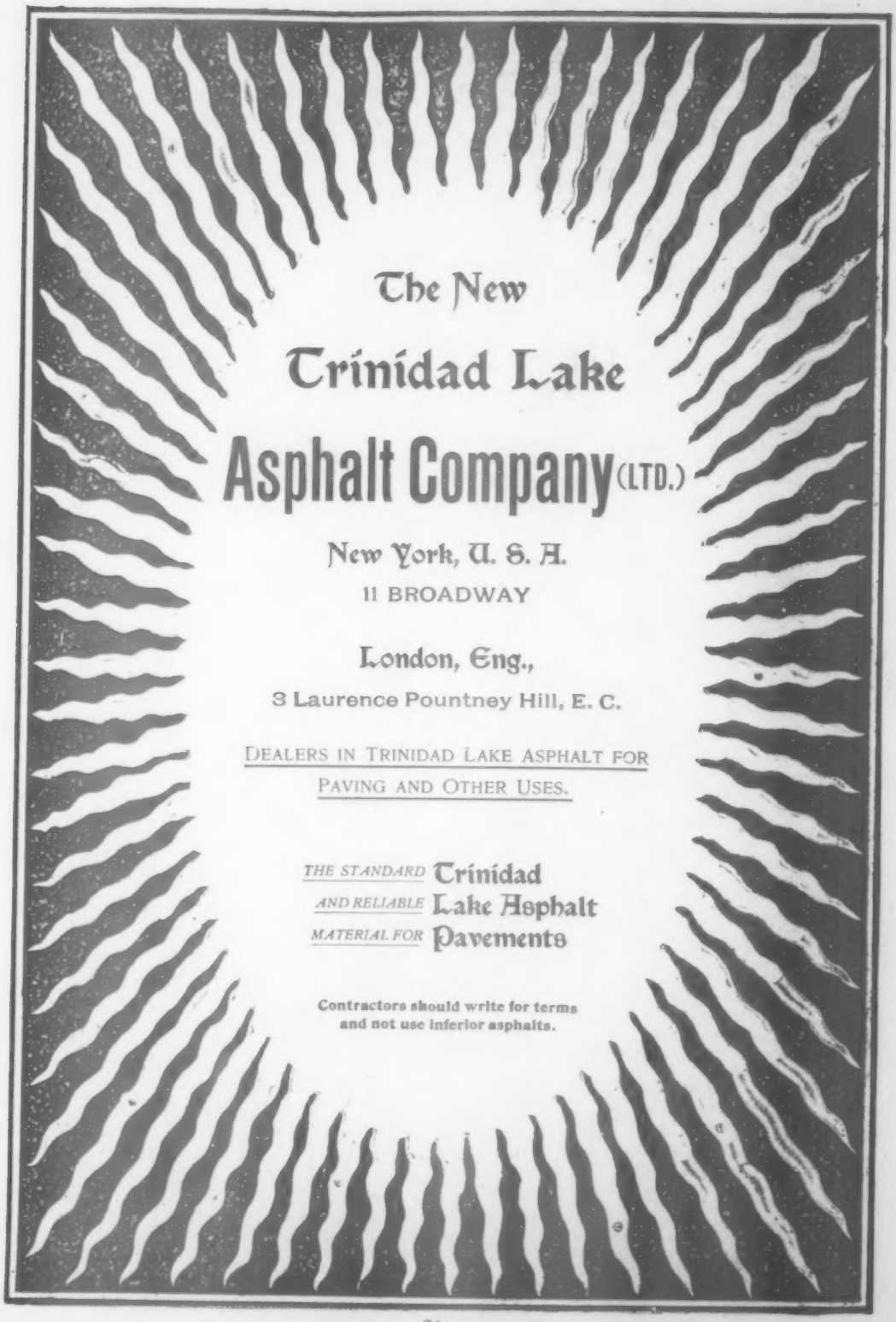

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